Exabyte Mammoth Tape Drive

SCSI Reference

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Revision History

Revision	Date
004	March 1996
005	June 1998

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About This Manual

This manual provides reference information for developing software to support applications for the Exabyte Mammoth Tape Drive.

Contents of This Manual

This manual contains the following information:

- **Chapter 1** provides an overview of how Mammoth implements the Small Computer System Interface (SCSI).

- **Chapter 2** provides background information and instructions for implementing common Mammoth operations in your application.

- **Chapter 3** through **Chapter 26** describe the SCSI commands supported by the tape drive. To help you find the information you need quickly, the SCSI commands are listed in alphabetic order.

- **Appendix A** describes tape drive message processing and error handling.

- **Appendix B** lists the possible combinations of values for the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields returned by the REQUEST SENSE (03h) command. It also lists the Fault Symptom Codes that may be returned by the REQUEST SENSE command and recommends recovery procedures for each Fault Symptom Code.

- **Appendix C** explains how to update your tape drive's microcode using an 8mm microcode update tape.

Conventions Used in This Manual

Important information in this manual is highlighted as follows:

Note: *Notes* provide hints or suggestions about the topic or procedure being discussed.

➤ **Important**   Text next to the heading "Important" provides information that will help you successfully complete a procedure or avoid additional steps in a procedure.

CAUTION

Boxed text under the heading "CAUTION" provides information you must know to avoid damaging the tape drive.

Related Publications

- *Exabyte Mammoth Tape Drive Product Specification*, 306482

- *Exabyte Mammoth Tape Drive Installation and Operation*, 306484

- ANSI *Small Computer System Interface-2 (SCSI-2)*, X3.131 – 1994

- ANSI *Helical-Scan Digital Computer Tape Cartridge*, X3B5/89-136, Rev. 6

- ANSI/ISO/IEC 11319-1992 and ECMA-145, *Information Technology – 8mm Wide Magnetic Tape Cartridge for Information Interchange*, July 1992

- Standard ECMA-169, *8mm Wide Magnetic Tape Cartridge Dual Azimuth Format for Information Interchange, Helical Scan Recording*, June 1992

- Draft Standard ECMA-XXX, *8mm Wide Magnetic Tape Cartridge for Information Interchange – Helical Scan Recording – DA-2 Format*

- *TapeAlert Specification*, Version 1.0, December, 1996

1   SCSI Communication

This chapter provides an overview of how the Small Computer System Interface (SCSI) is implemented for the Exabyte Mammoth tape drive. It discusses the following topics:

- SCSI commands supported by the tape drive
- Required format of SCSI commands
- Command statuses supported by the tape drive
- SCSI bus messages supported by the tape drive

Note: The *ANSI Small Computer System Interface-2 (SCSI-2) Specification* provides detailed information about SCSI physical characteristics. As described in that specification, SCSI devices can be daisy-chained together using a common cable. Both ends of the cable must be terminated. All signals are common between all bus devices.

1.1   Overview of SCSI Communications

Table 1-1 shows the commands, status information, and messages that are supported by the tape drive during SCSI bus phases.

Table 1-1   Overview of SCSI communications

SCSI Bus Phase	Explanation
Bus Free	BSY and SEL are false. The SCSI bus is idle and available for arbitration.
Arbitration	BSY and SCSI ID assertion (highest ID wins).
Selection	Winning ID asserts SEL. The initiator releases I/O and BSY. The tape drive sets BSY. The initiator releases SEL and asserts ATN.
Message Out	The initiator sends the Identify message and indicates whether disconnects are permitted. Other messages supported during the Message Out phase, but in a different bus sequence include: Extended Message (Synchronous Data Transfer Request) Extended Message (Wide Data Transfer Request*) Initiator Detected Error Abort Message Reject No Operation Message Parity Error Bus Device Reset
Command	The tape drive switches to Command phase. The initiator sends the command CDB. Commands supported by the tape drive include: ERASE · READ POSITION INQUIRY · RECEIVE DIAGNOSTIC RESULTS LOAD/UNLOAD · RELEASE UNIT LOCATE · REQUEST SENSE LOG SELECT · RESERVE UNIT LOG SENSE · REWIND MODE SELECT · SEND DIAGNOSTIC MODE SENSE · SPACE PREVENT/ALLOW MEDIUM REMOVAL · TEST UNIT READY · VERIFY READ · WRITE READ BLOCK LIMITS · WRITE BUFFER READ BUFFER · WRITE FILEMARKS
Data In/Out	The tape drive drives the bus to one of the Data phases and sends or receives data.

Table 1-1 Overview of SCSI communications (*continued*)

SCSI Bus Phase	Explanation
Status	The tape drive returns one byte of status information, as follows: Good Busy Check Condition Reservation Conflict
Message In	The tape drive returns one byte of message information, as follows: Command Complete Other messages supported during the Message In phase, but in a different sequence of bus activity, include: Extended Message (Synchronous Data Transfer Request) Extended Message (Wide Data Transfer Request[a]) Save Data Pointers Restore Pointers Disconnect Message Reject Ignore Wide Residue Identify

[a] Wide data transfers are supported by wide SCSI configurations of Mammoth only.

1.2   Supported SCSI Commands

The tape drive supports the SCSI commands shown in Table 1-2.

Table 1-2 Supported SCSI commands

Command	Operation code (hex)	What the tape drive does in response to this command	Described in
ERASE	19h	Erases the tape starting from the current legal position to the physical end of tape (PEOT). Rewinds the tape when finished.	Chapter 3
INQUIRY	12h	Provides the initiator with information about the tape drive's device parameters, including product and vendor identification.	Chapter 4
LOAD/ UNLOAD	1Bh	Loads or unloads a data cartridge. When loading a cartridge, the tape drive places the tape in the tape path and positions it at the logical beginning of tape (LBOT) or the logical beginning of the default partition. When unloading a data cartridge, the tape drive writes any buffered information to the tape, rewinds the tape to the physical beginning of the tape (PBOT), removes the tape from the tape path, and ejects the data cartridge (unless ejection has been prevented by a PREVENT/ALLOW MEDIUM REMOVAL command).	Chapter 5

Table 1-2 Supported SCSI commands (*continued*)

Command	Operation code (hex)	What the tape drive does in response to this command	Described in
LOCATE	2Bh	Positions the tape at a specified logical position. (Typically, this position is determined by data that was obtained through a previous READ POSITION command.)	Chapter 6
LOG SELECT	4Ch	Manages a set of internal counters regarding read and write error recovery operations and amounts of data compressed. The initiator can set threshold and cumulative values for the counters or reset the counters.	Chapter 7
LOG SENSE	4Dh	Returns the values of the counters managed by the LOG SELECT command.	Chapter 8
MODE SELECT	15h and 55h	Changes the tape drive's internal medium, logical unit, or device parameters to values specified by the initiator.	Chapter 9
MODE SENSE	1Ah and 5Ah	Provides the initiator with information about the tape drive's internal medium, logical unit, and device parameters.	
PREVENT/ ALLOW MEDIUM REMOVAL	1Eh	Prevents or allows the removal of the data cartridge from the tape drive. When the PREVENT MEDIUM REMOVAL command is in effect, the tape drive's unload button is disabled.	Chapter 10
READ	08h	Transfers data from the tape to the initiator.	Chapter 11
READ BLOCK LIMITS	05h	Provides the initiator with information about the maximum and minimum logical block lengths that the tape drive can support for read and write operations in the current operating mode.	Chapter 12
READ BUFFER	3Ch	Creates a diagnostic listing of the tape drive's current state or the contents of the tape drive's data buffer.	Chapter 13
READ POSITION	34h	Reports the current logical position of the tape to the initiator. This allows the initiator to store the position for later use in locating data with a LOCATE command.	Chapter 14
RECEIVE DIAGNOSTIC RESULTS	1Ch	Reports the results of diagnostic tests to the initiator.	Chapter 15
RELEASE UNIT	17h and 57h	Releases the tape drive from exclusive use by the initiator that had previously reserved it with a RESERVE UNIT command.	Chapter 16
REQUEST SENSE	03h	Provides the initiator with sense information describing a condition that just occurred.	Chapter 17

Table 1-2 Supported SCSI commands (*continued*)

Command	Operation code (hex)	What the tape drive does in response to this command	Described in
RESERVE UNIT	16h and 56h	Reserves the tape drive for exclusive use by the initiator that issued the command.	Chapter 18
REWIND	01h	Rewinds the tape to the logical beginning of the tape (LBOT) or the logical beginning of the current partition.	Chapter 19
SEND DIAGNOSTIC	1Dh	Performs diagnostic functions specified by the initiator. (For the initiator to receive the results of the tests, this command must be followed by a RECEIVE DIAGNOSTIC RESULTS command.)	Chapter 20
SPACE	11h	Searches forward or backward on the tape a specified number of logical blocks, filemarks, or setmarks.	Chapter 21
TEST UNIT READY	00h	Indicates whether the tape drive is ready to accept a medium access command (such as READ or WRITE) from the initiator.	Chapter 22
VERIFY	13h	Verifies the type or length of one or more logical blocks of data on the tape.	Chapter 23
WRITE	0Ah	Accepts data from the initiator to be written to the tape.	Chapter 24
WRITE BUFFER	3Bh	Transfers new microcode from the initiator into the tape drive's control memory.	Chapter 25
WRITE FILEMARKS	10h	Writes any data remaining in the tape drive's buffer to the tape, then writes a specified type and number of filemarks or setmarks following the data.	Chapter 26

1.3   SCSI Command Format

The SCSI command formats for the six- and ten-byte commands are shown in the *ANSI Small Computer System Interface 2 (SCSI-2)* standard. The commands for the tape drive are implemented according to this standard. The following are the formats for the six- and ten-byte command descriptor blocks (CDBs), followed by the format of the Operation Code and the typical format for the Control byte.

The word *Reserved* or *RSVD* as used in field definitions for SCSI commands has one of the following meanings:

- Fields defined as reserved by the *ANSI Small Computer System Interface 2 (SCSI-2)* standard. These fields are checked for a value of 0. If zeros are not present, Check Condition status is returned with the sense key set to Illegal Request (5h).

- Exabyte undefined fields. These fields are reserved for future enhancements and are not checked for illegal values

CDB for Six-Byte Commands

Bit Byte	7	6	5	4	3	2	1	0
00	Operation Code							
01	Logical Unit Number			Command Dependent				
02	(MSB)							
03	Logical Block Address							
04	(LSB)							
05	Control Byte							

CDB for Ten-Byte Commands

Bit Byte	7	6	5	4	3	2	1	0
00	Operation Code							
01	Logical Unit Number			Command Dependent				
02	(MSB)							
⋮	Logical Block Address							
05	(LSB)							
06	Reserved							
07	(MSB)							
08	Transfer, Parameter List, or Allocation Length (LSB)							
09	Control Byte							

Format of the Operation Code

Bit Byte	7	6	5	4	3	2	1	0
00	Group Code			Command Code				

Typical Format of the Control Byte.

Bit Byte	7	6	5	4	3	2	1	0
nn	Vendor Unique		Reserved				Flag	Link

1.4 Field Definitions for the Command Descriptor Block

The following sections provide field definitions for the six- and ten-byte command descriptor blocks (CDB).

Field Definitions for Six-Byte CDBs

Byte 00 – Operation Code

The Operation Code consists of two subfields, the Group Code and the Command Code, which are defined as follows:

Bits 7 through 5 – Group Code   The Group Codes supported by the tape drive are defined by the specific command.

Bits 4 through 0 – Command Code   The Command Codes supported by the tape drive are defined by the specific command.

Byte 01, Bits 7 through 5 – Logical Unit Number (LUN)

The LUN designates a specific unit within a group of devices associated with the target. Since the tape drive is a single device target and does not support multiple devices, the LUN must be 0 for all commands.

Byte 01, Bits 4 through 0 – Command Dependent

These bits are used as defined in the specific commands.

Bytes 02 through 04 – Logical Block Address

These bytes are used as defined in the specific commands.

Byte 05 – Control Byte

The Vendor Unique portion of the Control byte is defined for each specific command, if used. The tape drive does not support linked commands or recognize the Flag bit. The following are the field definitions for the Control byte:

Bits 7 and 6 – Vendor Unique   Command unique.

Bits 5 through 2 – Reserved   Must be 0.

Bit 1 – Flag   Must be 0.

Bit 0 – Link   Must be 0.

Field Definitions for Ten-Byte CDBs

Byte 00 – Operation Code

The Operation Code consists of two subfields, the Group Code and the Command Code, which are defined as follows:

Bits 7 through 5 – Group Code   The Group Codes supported by the tape drive are defined by the specific command.

Bits 4 through 0 – Command Code   The Command Codes supported by the tape drive are defined by the specific command.

Byte 01, Bits 7 through 5 – Logical Unit Number (LUN)

The LUN designates a specific unit within a group of devices associated with the target. Since the tape drive is a single device target and does not support multiple devices, the LUN must be 0 for all commands.

Byte 01, Bits 4 through 0 – Command Dependent

These bits are used as defined in the specific commands.

Bytes 02 through 05 – Logical Block Address

These bytes are used as defined in the specific commands.

Byte 06 – Reserved

Must be 0.

Bytes 07 and 08 – Transfer, Parameter List, or Allocation Length

These bytes contain the transfer length, the parameter list length, or the allocation length as required by the specific command.

Byte 09 – Control Byte

The Vendor Unique portion of the Control byte is defined for each specific command, if used. The tape drive does not support linked commands or recognize the Flag bit. The following are the field definitions for the Control byte:

Bits 7 and 6 – Vendor Unique   These bits are command unique.

Bits 5 through 2 – Reserved   Must be 0.

Bit 1 – Flag   Must be 0.

Bit 0 – Link   Must be 0.

1.5   Command Format Errors

A command format error may occur when:

- The Operation Code in the CDB is not supported by the tape drive.

- The Logical Unit Number in the CDB is not 0.

- The bytes or bits in a Reserved field (as defined by the ANSI SCSI-2 standard) are not 0.

- The Link or Flag fields of the Control byte (bits 1 and 0) are not 0, or the Vendor Unique fields (bits 7 and 6) are not valid definitions for the specific command.

For all command format errors, the command is terminated and Check Condition status is returned to the initiator. The sense data is set as follows:

- The sense key is set to Illegal Request (5h).

- Depending on the specific error, the Additional Sense Code (ASC) is set to Illegal Operation Code (20h), Logical Unit Not Supported (25h), or Invalid Field in CDB (24h).

- The Additional Sense Code Qualifier (ASCQ) is set to 0.

- The sense key specific data indicates the location of the error.

1.6　Command Status

One status byte is sent from the tape drive to the initiator at the completion of a command. The format of the status byte is shown below.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Status Byte Code					

The meaning of the Status Byte Code is shown in Table 1-3. Note that the value of bit 0 is always 0.

Table 1-3　Definition of the Status Byte code

Hex Value	Bit						Meaning
	5	4	3	2	1	0	
00h	0	0	0	0	0	0	**Good**. Indicates that the tape drive successfully completed the command.
02h	0	0	0	0	1	0	**Check Condition.** Indicates any error, exception, or abnormal condition that causes sense information to be set.
08h	0	0	1	0	0	0	**Busy.** Indicates that the tape drive is busy. This status is sent whenever the tape drive is unable to accept a command from an initiator.
18h	0	1	1	0	0	0	**Reservation Conflict.** Indicates that the tape drive is reserved for the exclusive use of another initiator.

Status Byte Explanations

The following sections explain the status bytes supported by the tape drive and the reasons they are sent.

Good

Good status indicates that the operation specified by the CDB completed normally. For those commands that support the immediate return of status, Good status indicates that the tape drive has accepted the command and will attempt to perform the operation specified by the CDB. If the specified operation does not complete normally, Check Condition status will be reported to the initiator when the next command is received by the tape drive from the same initiator.

Check Condition

The tape drive returns Check Condition status to indicate that a situation occurred during the execution of a command that should be checked by the initiator. Check Condition status does not necessarily mean that the command has failed to complete successfully.

The reporting of Check Condition status is immediate or deferred as follows:

- If status for the command is to be returned when the command is completed, Check Condition status is reported when the condition occurs (immediate error reporting).

- If status for the command was returned when the command was initiated (that is, before the condition occurred), Check Condition status is reported when the next command is received from the same initiator (deferred error reporting).

- If the condition occurs while the command is executing and the tape drive is disconnected from the initiator, Check Condition status is reported to the initiator after the reconnect process.

For specific situations that return Check Condition status, refer to the command descriptions in Chapter 3 through Chapter 26.

Check Condition status is reported when a command is received in the following cases:

- There is a bus parity error or format check error in a CDB.

- The command is the first command sent to the tape drive after it was reset by a SCSI bus reset or a Bus Device Reset message or after the data cartridge was replaced. The sense key in the sense data indicates Unit Attention (6h).

- A log counter has overflowed.

Always issue a REQUEST SENSE command to determine the cause of the Check Condition status.

Busy

Busy status indicates that the tape drive is in the busy state. The tape drive is in a busy state when it is performing an internal operation that will not allow another command to be accepted until the operation is complete.

The tape drive returns Busy status for a command request until the busy state is released. For this reason, the initiator must reissue the command to the tape drive. Once the busy state is released, selection operation and commands can be executed normally.

Reservation Conflict

Reservation Conflict status indicates that the tape drive is currently reserved for the exclusive use of another initiator. This status is reported until the initiator that reserved the tape drive issues a RELEASE UNIT command or a reset condition occurs.

Note: The tape drive does not report Reservation Conflict status for REQUEST SENSE (03h) or INQUIRY (12h) commands.

1.7 Message System

The message system allows communication between the initiator and the tape drive for physical path management. Table 1-4 lists the messages supported by the tape drive. Refer to Appendix A for information about the specific actions the tape drive takes in response to messages from the initiator.

Table 1-4 Supported SCSI messages

Hex Value	Message	Direction	
		In (Tape drive to initiator)	Out (Initiator to tape drive)
00h	Command Complete	✔	
01h	Extended Messages: (Synchronous Data Transfer Request) (Wide Data Transfer Request[a])	✔	✔
02h	Save Data Pointers	✔	
03h	Restore Pointers	✔	
04h	Disconnect	✔	
05h	Initiator Detected Error		✔
06h	Abort		✔
07h	Message Reject	✔	✔
08h	No Operation		✔
09h	Message Parity Error		✔
0Ch	Bus Device Reset		✔
23h	Ignore Wide Residue	✔	
80h or C0h	Identify	✔	✔

[a] Wide data transfers are supported by wide SCSI configurations of Mammoth only.

Command Complete (00h)

The tape drive sends the Command Complete message to the initiator to indicate that the execution of a command has terminated and that valid status has been sent to the initiator. After successfully sending this message, the tape drive goes to the Bus Free phase.

Extended Messages (01h)

The tape drive supports the following extended messages:

- Synchronous Data Transfer Request
- Wide Data Transfer Request

Note: The Wide Data Transfer Request message automatically resets an existing synchronous data transfer agreement to asynchronous mode. If both synchronous and wide data transfers are desired, the synchronous data transfer must be negotiated after the wide data transfer.

Synchronous Data Transfer Request

The Synchronous Data Transfer Request message is used to negotiate synchronous data transfer agreements. If the initiator wants to transfer data synchronously, it must negotiate a synchronous data transfer agreement before transferring data.

Note: The tape drive will not originate a synchronous data transfer request; instead, it sends a Synchronous Data Transfer Request message in response to the initiator's request.

A synchronous data transfer negotiation is accomplished as follows:

1. The initiator sends a Synchronous Data Transfer Request message to the tape drive. This message specifies a transfer period and a REQ/ACK offset.

2. The tape drive returns a Synchronous Data Transfer Request message. The transfer period returned by the tape drive will be equal to or greater than the initiator's value, and the REQ/ACK offset will be less than or equal to the initiator's value.

The agreement can be terminated immediately after the negotiation if the initiator asserts the Attention signal and then sends a Message Reject message.

Once negotiated, the synchronous transfer agreement stays in effect with the initiator until one of the following events occurs:

- The transfer agreement is renegotiated.
- A wide data transfer negotiation occurs.
- The tape drive is reset (SCSI bus reset, Bus Device Reset message, or power-on reset).

The format of the Synchronous Data Transfer Request message is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Extended Message Length							
02	Extended Message Code							
03	Transfer Period							
04	REQ/ACK Offset							

Byte 00 – Extended Message   The valid value for the Extended Message field is 01h, indicating that this is an extended message that contains multiple bytes.

Byte 01 – Extended Message Length   The valid value for the Extended Message field is 03h, indicating that there are three additional message bytes to be transferred, not including this byte.

Byte 02 – Extended Message Code   The Extended Message Code byte identifies the specific extended message being sent. The valid value for this byte is 01h, indicating that the Extended Message is a Synchronous Data Transfer Request.

Byte 03 – Transfer Period   This byte identifies the minimum time allowed between leading edges of successive REQ pulses and ACK pulses for successful reception of data. The value represents the number of 4-nanosecond increments allowed for the synchronous transfer period. The tape drive supports a minimum of 25 increments or 100 nanoseconds for the minimum synchronous transfer period.

Byte 04 – REQ/ACK Offset   This byte identifies the maximum number of REQ pulses that can be outstanding before the leading edge of the corresponding ACK is received by the tape drive. The tape drive allows up to 16 outstanding REQ pulses.

Wide Data Transfer Request

The Wide Data Transfer Request message is used to negotiate the width of the data path for data transfers between the tape drive and the initiator. The width applies to data phases only (Data In and Data Out); all other information transfers use an eight-bit data path. Wide data transfers are supported by wide SCSI configurations of Mammoth only.

Only the initiator can send a Wide Data Transfer Request message to initiate wide data transfer negotiations. The initiator indicates the maximum transfer width it wants to support. If the tape drive can support this transfer width, it returns a Wide Data Transfer Request message echoing the transfer width value. If the tape drive requires a smaller transfer width, it returns a smaller value that automatically becomes the agreed upon transfer width.

The agreement can be terminated immediately after the negotiation if either device asserts the Attention signal and then sends a Message Reject message. Once negotiated, the wide data transfer agreement stays in effect until renegotiated or until a reset condition (SCSI bus reset, Bus Device Reset message, or power-on reset) occurs.

The format of the Wide Data Transfer Request message is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Extended Message Length							
02	Extended Message Code							
03	Transfer Width Exponent							

Byte 01 – Extended Message Length   The valid value for the Extended Message Length is 02h, indicating that there are two additional message bytes to be transferred, not including this byte.

Byte 02 – Extended Message Code   The Extended Message Code byte identifies the specific extended message being sent. The valid value for this byte is 03h, indicating that the Extended Message is a Wide Data Transfer Request.

Byte 03 – Transfer Width Exponent Determines the width of the data path for data transfers. The transfer width is 2 raised to this value in bytes. The valid values are:

00h – Transfer width is 2^0 = 1 byte (8 bits) wide.
01h – Transfer width is 2^1 = 2 bytes (16 bits) wide.

Save Data Pointer (02h)

The tape drive sends the Save Data Pointer message to direct the initiator to save a copy of its present active data pointer for the tape drive.

Restore Pointers (03h)

The tape drive sends the Restore Pointers message to direct the initiator to restore the most recently saved data pointers for the currently attached LUN to the active state. Pointers to the Command, Data, and Status locations for the LUN are restored to the active pointers. Command and Status pointers are restored at the beginning of the present command and status areas. The data pointer is restored to the value at the beginning of the data area or the most recent Save Data Pointer value.

Disconnect (04h)

The tape drive sends the Disconnect message to inform the initiator that the present physical path will be broken (the tape drive will disconnect by releasing the BSY signal) and that a later reconnect is required to complete the current operation. If the disconnect privilege has been granted by the initiator, the tape drive can send this message at any time after receiving the CDB (except as restricted by the ND bit of the MODE SELECT command).

If the tape drive does not send either the Disconnect message or the Command Complete message before going to the Bus Free phase (other than as a result of the reset condition), one of the following situations has occurred:

- A catastrophic error condition has occurred for the current command
- The initiator aborted the command

Note: The Disconnect message should not cause the initiator to save the data pointer.

Initiator Detected Error (05h)

The initiator sends the Initiator Detected Error message to inform the tape drive that an error has occurred that does not preclude the tape drive from retrying the operation. Generally, the initiator sends this message when it has detected a parity error in a non-message phase, such as Status In or Data In. The present pointer integrity is not ensured.

Abort (06h)

The initiator sends the Abort message to the tape drive to clear the present operation. All pending data and status for the issuing initiator is cleared and the tape drive goes to the Bus Free phase. No status or ending message is sent for the operation.

If a process is aborted, the tape drive generates sense data that indicates how the process terminated (either aborted or an error condition).

Message Reject (07h)

Either the tape drive or the initiator can send the Message Reject message to indicate that the last message received was inappropriate or has not been implemented.

Note: If the initiator sends a Message Reject message after a non-message phase, the tape drive treats this as an error by the initiator and aborts any processes owned by the initiator.

To indicate its intention of sending this message, the initiator must assert the Attention signal before releasing ACK for the REQ/ACK handshake of the message that will be rejected. When the tape drive sends this message, it changes to the Message In phase and sends this message before requesting additional message bytes from the initiator. This provides an interlock so that the initiator can determine which message is rejected.

No Operation (08h)

The initiator sends the No Operation message in response to the tape drive's request for a message when the initiator does not currently have any other valid message to send.

Message Parity Error (09h)

The initiator sends the Message Parity Error message to the tape drive to indicate that the last message it received had a parity error. The tape drive responds by re-sending the previous message.

Note: If the tape drive receives a Message Parity Error message when the last phase was not Message In, it sends a Message Reject message to the initiator.

To indicate its intention of sending this message, the initiator must assert the Attention signal before releasing ACK for the REQ/ACK handshake of the message that has the parity error. This provides an interlock so that the tape drive can determine which message has the parity error.

Bus Device Reset (0Ch)

The initiator sends the Bus Device Reset message to direct the tape drive to reset all current I/O operations. This message forces the tape drive to an initial state with no operations pending for any initiator. Upon recognizing this message, the tape drive goes to the Bus Free phase.

Note: Refer to Section 2.8 for more information about the effect of the Bus Device Reset Message.

Ignore Wide Residue (23h)

The tape drive sends the Ignore Wide Residue message to indicate that the number of valid bytes sent during the last REQ/ACK handshake and REQB/ACKB handshake of a Data In phase was less than the negotiated transfer width. This message is sent immediately following the Data In phase, before any other messages.

The format of the Ignore Wide Residue message is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	0	0	0	1	1
01	Ignore							

Byte 01 – Ignore   Indicates the number of invalid data bytes transferred, as follows:

00h – Reserved
01h – One byte is invalid (bits 15 through 8 of a 16-bit transfer)
02h to FFh – Reserved

Identify (80h or C0h)

Either the initiator or the tape drive can send the Identify message. The message is used to establish the physical path connection between an initiator and the tape drive.

When the tape drive sends the Identify message to the initiator during reconnection, an implied Restore Pointers message must be implemented by the initiator before completion of this message.

The format of the Identify message is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	Identify	DiscPriv	LUNTAR	Reserved		LUNTRN		

Bit 7 – Identify   The Identify bit is set to 1 to distinguish the Identify message from all other messages.

Bit 6 – DiscPriv   The initiator sets the DiscPriv (disconnect privilege) bit to grant the tape drive disconnect privileges.

0 – Disconnect is not allowed
1 – Disconnect is allowed

Bit 5 – LUNTAR   The tape drive does not support this field; the only valid value for this field is 0.

Bits 2 through 0 – LUNTRN   The tape drive is a single device target and does not support multiple devices; therefore, the LUN must be 0.

Message Sequence

When the tape drive connects to the SCSI bus, the following sequence of events occurs:

1. The initiator indicates its ability to accommodate more than the Command Complete message by asserting the Attention signal in the Selection phase before the Select signal is driven true and the Busy signal is driven false.

2. To indicate its ability to accommodate more than the Command Complete message, the tape drive responds to the Attention signal by transitioning to the Message Out phase immediately after completing the Selection phase.

3. If the initiator supports messages other than Command Complete, the first message sent by the initiator after the Selection phase is the Identify message. This allows the physical path to be established for the LUN specified by the initiator. The tape drive supports an LUN of 0 only.

4. If the DiscPriv bit (bit 6) in the Identify message is set, the tape drive may send the Disconnect message to the initiator when a command is not complete and there is no status or data available.

or

If the DiscPriv bit is not set, the tape drive will never send the Disconnect message.

5. If the physical path has been broken temporarily, the tape drive will re-establish the communication path with the initiator by entering the Reselection phase. After completing the reselection, the tape drive will send an Identify message to the initiator to re-establish the physical path.

See Appendix A for more detailed information about how the tape drive processes messages and handles errors during various SCSI bus phases.

2 Implementing Tape Drive Operations

This chapter explains how to implement common tape drive operations in your application. It includes information about the following:

- Using data cartridges for Mammoth
- Using data compression
- Setting the size of logical blocks
- Using filemarks and setmarks
- Maximizing data transfer efficiency
- Formatting and using partitioned tapes
- Handling Unit Attention conditions
- Resetting the tape drive

2.1 Using Data Cartridges for Mammoth

Mammoth writes to EXATAPE™ advanced metal evaporated (AME) data cartridges. These cartridges are available from Exabyte in lengths of 22m and 170m. EXATAPE AME data cartridges require no formatting or conditioning before use.

The tape drive can also read data from metal particle (MP) tape when it is written in one of the following formats: 8500c, 8500, or 8200. The tape drive cannot read or write 8200c format tapes. When you attempt to read an 8200c format tape, the tape drive returns Check Condition Status with a sense key of Medium Error (3h) and an FSC of 1Ch.

➤ **Important .** Although the tape drive can read data from metal particle tape, it cannot write data to this type of tape. You must use EXATAPE data-grade advanced metal evaporated media for writing data.

Loading a Data Cartridge

When you insert a data cartridge into the tape drive, the tape drive automatically loads the tape into the tape path. It determines the tape's format and length, and positions the tape at the logical beginning of tape (LBOT). The tape drive then goes to the ready state (middle LED on).

➤ **Important**   Do not insert a cartridge until the tape drive has finished its power-on self-test (all three LEDs off). If you try to insert a cartridge before POST is complete, the tape drive will eject the cartridge.

If you want to prevent automatic loading, you can disable it using the NAL bit of the MODE SELECT command (see). If you have prevented autoloading, you must issue a LOAD (1Bh) command to load the tape.

Unloading a Data Cartridge

When you press the unload button, the following actions occur (assuming that a data cartridge is loaded and the tape drive is ready).

Note: If you have prevented media removal with a PREVENT/ ALLOW MEDIUM REMOVAL command, the tape drive performs no action when you press the unload button.

1. Any command or operation currently in progress is completed.

2. Any buffered information is written to tape, and an EOD mark is written to indicate the end of data.

3. The tape is rewound to the physical beginning of tape (the point where the translucent leader material is attached to the media).

4. The tape is unloaded from the tape path.

5. The data cartridge is ejected.

Status Reported for Unload Procedure

If a command is issued to the tape drive during the unload procedure, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h). Once the Unit Attention condition is reported, all subsequent commands (except INQUIRY and REQUEST SENSE) receive Check Condition with the sense key set to Not Ready (2h). (For information about clearing a Unit Attention condition, see .)

Error During Unload Procedure

If an error exists before or during the unload procedure, the unload sequence will be suspended and the top LED will flash. If the unload button is pressed again, the unload sequence will be reattempted; however, unwritten data in the buffer will not be written to tape. The buffer and errors will be cleared.

2.2   Using Data Compression

Mammoth writes data in Mammoth format only. By default, Mammoth writes compressed data. Mammoth compresses data at an average ratio of 2:1. However, the actual compression ratio may be higher or lower depending on the type of data.

When writing compressed data, Mammoth monitors the compression ratio and automatically switches between compressed and uncompressed format when necessary (for example, Mammoth turns off compression when the data is already compressed). For this reason, you should not need to turn compression on and off for individual blocks. However, if you want, you can use the DCE (data compression enable) bit of the MODE SELECT command to specify compressed or uncompressed format at any position on the tape (see).

2.3 Setting the Size of Logical Blocks

Logical blocks are the basic units of data transfer between the initiator and the tape drive.

When you use the WRITE or READ commands, you can specify fixed-length or variable-length logical blocks. If you write or read fixed-length logical blocks, you can transfer one or more logical blocks with each command. You specify the block length using the Block Length field in the Block Descriptor of the MODE SELECT command. If you write or read variable-length logical blocks, you transfer just one logical block with each command. You specify the block length in the Transfer Length field of the WRITE or READ command.

You can set the size of the logical data blocks to values between 1 byte and 240 KB. However, for tape drive efficiency, choose a size that is an even number between 256 bytes and 64 KB. For variable-length logical blocks, try to use a block size no smaller than 4 KB. In general, larger logical blocks transfer more efficiently than smaller logical blocks.

If you use logical blocks that are smaller than the recommended range, tape drive efficiency is reduced in the following areas:

- **Tape capacity.** The tape drive adds header and error correction information to each logical block it writes to tape. If you use very small logical blocks, significant overhead is added to the data recorded on the tape.

- **Compression.** The tape drive compresses data on a block-by-block basis by building a translation table for each logical block. Very small logical blocks slightly reduce compression efficiency because a new table has to be built for each block.

If you use logical blocks that are larger than the recommended range, tape drive efficiency is reduced in the following areas:

- **Buffer use.** The tape drive does not transfer partial logical blocks. Before a logical block can be written to tape or sent to the host, the full logical block must be present in the tape drive's buffer. Very large logical blocks reduce buffer efficiency because the tape drive has to hold the block in the buffer for a longer amount of time than a smaller logical block.

- **Error recovery.** Error recovery is performed on a block-by-block basis. Although error recovery is rarely necessary, it requires the retransmission of data. Large logical blocks require a longer retransmission time than small blocks and make less efficient use of the buffer.

2.4   Using Filemarks and Setmarks

Filemarks and setmarks enable an initiator to locate particular blocks of data using high-speed search. When writing data to tape, an initiator can use WRITE FILEMARKS commands to write filemarks or setmarks to indicate data boundaries. When reading the tape, the initiator can use a SPACE command to position the tape to data marked by a filemark at up to 63 times the normal tape speed. Setmarks provide an additional way to indicate data boundaries on the tape; in a sense, they can be thought of as a "hierarchically superior" filemark.

Long Filemarks

The long filemark is 94.7 KB long and consists of six tracks of information:

- Two gap tracks at the beginning
- Two tracks of long filemark physical blocks
- Two gap tracks at the end

The information in the filemark physical blocks identifies the filemark's number and location on the tape. This information cannot be accessed or changed by the user. The gap tracks at the beginning and the end allow file append and file splice operations. The tape drive may write additional gap tracks and gap blocks before the filemark to ensure that all data has been written to tape correctly or to complete tracks that are not completely filled with data blocks.

Short Filemarks

The short filemark consists of a single 1-KB physical block. The physical block contains information identifying the filemark's number and location on the tape. Short filemarks cannot be used as splice points.

If you do not need a splice point, it is recommended that you use short filemarks instead of long filemarks to conserve tape space.

Setmarks

Setmarks function similarly to the long filemark. You can issue a SPACE (11h) command to space to setmarks in the same way you space to filemarks; however, you can also use a MODE SELECT (15h) command to suppress setmark detection during read, verify, space block, and space filemark operations.

The setmark is the same length as the long filemark. For additional information about using setmarks, refer to .

2.5   Maximizing Data Transfer Efficiency

When reading or writing data, the tape drive can operate as either a *streaming* or *start/stop* tape device, depending on the data transfer rate of the host system. In streaming mode, the tape drive transfers data continuously (to tape or to the host) without stopping tape motion. In start/stop mode, the tape drive stops and restarts tape motion to accommodate a slow host transfer rate.

If your system permits, operating the tape drive in streaming mode can maximize the amount of data you can store on a tape and minimize the amount of wear on the tape and recording heads. To enable the tape drive to operate in streaming mode, the host must be able to transfer data at a minimum of 3.0 MB per second if the tape drive is writing uncompressed data or 6.0 MB per second if the tape drive is writing compressed data.

No matter what data transfer rate the host uses, the tape drive automatically adjusts to the rate to provide optimum data transfer efficiency. As explained below and on the following pages, you can use this default mode of operation (*auto-thresholding*) or you can manually control how the tape drive adjusts to host transfer rates.

Buffer Management

The tape drive uses its 4-MB data buffer to adapt to the data transfer rate of the host. By monitoring buffer thresholds, the tape drive determines the optimum point to transfer data between the buffer and host or between the buffer and tape.

Streaming Mode   When operating in streaming mode, the tape drive adapts to the host's data transfer rate by disconnecting from and reconnecting to the SCSI bus. The tape drive determines when to reconnect to the SCSI bus by comparing how full the buffer is to the *reconnect threshold*, as follows:

- During a write operation, if the tape drive's buffer fills with data from the host faster than the tape drive can write the data to tape, the tape drive disconnects from the SCSI bus while continuing to write data until the amount of space available in the buffer is equal to the reconnect threshold. The tape drive then reconnects to the SCSI bus to accept more data.

- During a read operation, if the host can accept data from the tape drive's buffer faster than the tape drive can fill the buffer with data from the tape, the tape drive disconnects from the SCSI bus until it has filled the buffer back up to a level equal to the reconnect threshold. Then the tape drive reconnects to the SCSI bus to transfer more data.

Start/Stop Mode   When operating in start/stop mode, the tape drive adapts to the host's data transfer rate by starting and stopping tape motion. The tape drive determines when to restart tape motion by comparing how full the buffer is to the *motion threshold*, as follows:

- During a write operation, the tape drive waits until the buffer is filled to a certain level (the motion threshold), starts the tape, records the buffered data, then stops the tape until the buffer can be filled to that level again by the host.

- During a read operation, the tape drive fills the buffer with data from the tape, stops the tape, waits for the host to accept enough data to empty the buffer to the motion threshold, then starts the tape and fills the buffer again.

Using Auto-Thresholding

By default, the tape drive automatically adjusts the reconnect and motion thresholds based on the host's data transfer rate to optimize throughput (*auto-thresholding*). It is recommended that you operate the tape drive with auto-thresholding on at all times. However, if you want to test different thresholds, you can turn auto-thresholding off and set the thresholds manually, as described below.

Turning Auto-Thresholding Off

To turn auto-thresholding off, you must set either the motion threshold or the reconnect threshold (or both) to a non-zero value between 20h and D0h. Each 1h = 0.39% of the buffer (for example, 80h equals half the buffer).

To turn auto-thresholding off, use the MODE SELECT command as summarized in Table 2-1.

Table 2-1   How to turn auto-thresholding off

To turn auto-thresholding off, use the MODE SELECT command as follows...		
Send any of these pages...	**With this field (or fields) set to a non-zero value between 20h and D0h...**	**Notes**
Disconnect- Reconnect Page (02h)	Buffer Full Ratio—Byte 02 **AND** Buffer Empty Ratio—Byte 03 (Must be the same value.)	These values set the reconnect threshold. If you send no other page, the motion threshold returns to the non-zero value last set by a MODE SELECT command.
Device Configuration Page (10h)	Write Buffer Full Ratio—Byte 04 **AND** Read Buffer Empty Ratio—Byte 05 (Must be the same value.)	These values set the motion threshold. If you send no other page, the reconnect threshold returns to the non-zero value last set by a MODE SELECT command.
Vendor Unique Parameters Page 1 (20h)	Motion Threshold—Byte 04	If you send no other page, the reconnect threshold returns to the non-zero value last set by a MODE SELECT command.
(Non-page format)	Reconnect Threshold—Byte 03 of the vendor-unique parameters **OR** Motion Threshold—Byte 02 of the vendor-unique parameters	You can set both fields to a non-zero value if you want. If you set just one, the other returns to the non-zero value last set by a MODE SELECT command.

> **Note:** If you send conflicting values on different pages of the MODE SELECT command, the value that is received last by the tape drive takes precedence.

Guidelines for Setting the Thresholds If you turn auto-thresholding off, choose a setting for the motion or reconnect threshold based on the following guidelines:

- A good starting point for both thresholds is 80h, which represents one half of the buffer.

- If the tape drive is operating in streaming mode, you can reduce the number of disconnects and reconnects between the tape drive and host by increasing the reconnect threshold.

- If the tape drive is operating in start/stop mode, you can reduce the number of start/stop operations by increasing the motion threshold.

Turning Auto-Thresholding Back On

To turn auto-thresholding back on, you must set both the motion and reconnect threshold to 0 using a single MODE SELECT command, as summarized in Table 2-2.

Table 2-2 How to turn auto-thresholding back on

To turn auto-thresholding back on, use the MODE SELECT command as follows...	
Send any of these page combinations...	**With these fields set to 0...**
Disconnect-Reconnect Page (02h) **AND** Device Configuration Page (10h)	Buffer Full Ratio—Byte 02 and Buffer Empty Ratio—Byte 03 of the Disconnect-Reconnect Page **AND** Write Buffer Full Ratio—Byte 04 and Read Buffer Empty Ratio—Byte 05 of the Device Configuration Page
Disconnect-Reconnect Page (02h) **AND** Vendor Unique Parameters Page 1 (20h)	Buffer Full Ratio—Byte 02 and Buffer Empty Ratio—Byte 03 of the Disconnect-Reconnect Page **AND** Motion Threshold—Byte 04 of Vendor Unique Parameters Page 1
(non-page format)	Reconnect Threshold—Byte 03 of the vendor-unique parameters **AND** Motion Threshold—Byte 02 of the vendor-unique parameters

Note: It is not an error to set just one of the thresholds to 0. However, if you set just one threshold to 0, the tape drive ignores the setting and neither threshold value is changed.

Example—Turning Auto-Thresholding Off and On

The following example demonstrates what happens when you use the MODE SELECT command to turn auto-thresholding off and on:

1. The tape drive is powered on. By default, auto-thresholding is on, and the motion and reconnect thresholds are set to their power-on defaults (80h).

2. A MODE SELECT command is issued that sets the reconnect threshold to 21h and the motion threshold to 50h. This turns auto-thresholding off.

    The thresholds remain at these values during all subsequent write and read operations until they are changed by another MODE SELECT command or until a power cycle occurs.

3. A MODE SELECT command is issued that sets both the reconnect and motion thresholds to 0. This turns auto-thresholding back on.

    During subsequent write and read operations, the thresholds are automatically adjusted to optimize throughput. A MODE SENSE command after any read or write operation would reflect the new adjusted values for the thresholds.

4. A MODE SELECT command is issued that sets the motion threshold to 80h, but does not set the reconnect threshold. This turns auto-thresholding off. The motion threshold is set to 80h, and the reconnect threshold is set to the last value set by a MODE SELECT command before auto-thresholding was turned on (21h from step 2).

5. A MODE SELECT command is issued that sets the reconnect threshold to 0, but does not set the motion threshold. This is not an error, but neither threshold is changed and auto-thresholding remains off.

6. The tape drive is powered off and back on. Auto-thresholding turns on as a result of the power cycle.

2.6 Formatting and Using Partitioned Tapes

Mammoth can write and read tapes containing up to 64 partitions. A *partition* is a self-contained writable and readable area on a tape. A standard tape is considered a single-partition tape. That is, there are no divisions on the tape, and you can write to and read the entire tape as normal. A multi-partition tape is a tape that has been divided into two or more separate writable and readable areas (partitions). Note that partitions are not the divisions between separate areas on the tape; rather, they are the separate areas themselves.

Each partition on a tape contains a logical and physical beginning (LBOP and PBOP) and a logical and physical end (LEOP and PEOP). The tape drive considers each partition a completely self-contained recording area independent of the other partition on the tape. The tape drive cannot move the tape beyond the beginning or end of a partition unless specifically requested to by a LOCATE (2Bh) or MODE SELECT (15h) command. In effect, the tape drive treats each partition as if it were a separate tape.

Creating a Partitioned Tape

To create a partitioned tape, you format the tape using the Medium Partition Page (11h) of the MODE SELECT (15h) command. The Medium Partition Page lets you specify how many partitions will be on the tape and what their sizes will be.

Note that a standard blank tape is considered to have one partition. You do not need to format a blank tape if you want only one partition. The only time you would specify one partition when you are formatting a tape is if you want to change a multi-partition tape back to a single-partition tape.

A summary of the steps you take to create a multi-partition tape from an unformatted (or single-partition) tape follows. (Refer to Chapter 9 for specific details about using the MODE SELECT command.)

1. Load a tape into the tape drive, or rewind the current tape to the logical beginning of tape (LBOT). The tape must be positioned at LBOT or at the logical beginning of a partition (LBOP) before you can format the tape with new partitions.

2. Issue a MODE SELECT command and specify page format (PF= 1). Specify the following parameters for the partitions in the Medium Partition Page (Page Code= 11h):

   ▪ For Additional Partitions Defined, specify the number of partitions you want defined in addition to the original partition (the entire tape).

   ▪ Set FDP (Fixed Data Partitions), SDP (Select Data Partitions), or IDP (Initiator Defined Partitions) to 1 depending on how you want the size of the partitioned determined. (Note that you can set only one of these fields.) If FDP= 1, the partition will encompass the entire tape, resulting in a single-partition tape. If SDP= 1, the partitions will be a size that is predefined by the tape drive. If IDP= 1, the partitions will be the size you specify.

   ▪ If you choose to define the partition sizes yourself (IDP= 1), use PSUM (Partition Size Unit of Measure) to specify the units of measure you will use to specify the size. Use the Partition Size fields to specify each partition's size. (Note that if you specify a total value for the Partition Sizes that is larger than the amount of space available on the tape, the format will fail with a sense key of Illegal Request (5h).)

3. Wait for the formatting process to be completed (several minutes depending on the partition sizes). When the tape drive has finished formatting the tape, it will position the tape at the beginning of the default partition (the last partition on the tape). At this point, you can begin writing data or performing other tape operations as described in the following section.

Using a Multi-Partition Tape

The easiest way to use a multi-partition tape is to think of it as separate tapes. Just as you would have to physically change tapes to access data on another tape, you have to specifically request that the tape be moved to the another partition before you can perform actions in that partition. The following are descriptions of how to perform several typical actions on a multi-partition tape.

Loading a Partitioned Tape

You load a multi-partition tape exactly as you would a standard tape. However, you have a choice of which partition the tape drive positions the tape to immediately after it is loaded. By default, the tape drive positions to the last partition on the tape.

If you want to override the default partition, issue a MODE SELECT command before loading the tape (or while the previous tape is loaded). Specify page format (PF= 1) and send Vendor Unique Parameters Page 2 (Page Code= 21h). For LPART (Load Partition), indicate which partition you want the tape to be positioned to.

Note: The setting of LPART remains in effect until the tape drive is reset.

Changing Partitions

If you want to move the tape from one partition to the logical beginning of another partition (LBOP), use either of the following methods:

Method 1 – LOCATE command   Issue a LOCATE (2Bh) command. Specify the following parameters:

- Set CP (Change Partitions) to 1 to indicate you want to change partitions.

- For Block Address, specify the block to which you want the tape moved.

- Set Partition to the number of the partition to which you want to change.

Method 2 – MODE SELECT command   Issue a MODE SELECT command. Specify page format (PF= 1) and send the Device Configuration Page (Page Code= 10h). Specify the following parameters:

- Set CAP (Change Active Partition) to 1 to indicate that you want the tape to be moved to another partition.

- Set Active Partition to the number of the partition to which you want to move.

  Note: The tape drive does not reposition the tape until it receives a tape motion command that requires the repositioning, such as READ (08h), WRITE (0Ah), or SPACE (11h).

Writing Data in Partitions

To write data, use the WRITE (0Ah) command as you would with a standard tape. However, remember that if you want to write data in the partition the tape is not currently in, you must first use the MODE SELECT or LOCATE command to change partitions. If you use MODE SELECT, the tape drive repositions the tape to the new partition after it receives a tape motion command such as SPACE (11h).

Writing to PEOP   When you are writing data to a partition, you can never overwrite the end of the partition. If the tape drive encounters the logical end of the partition (LEOP), it returns Check Condition status as if it had encountered the logical end of the tape (LEOT). You can choose to write to the physical end of the partition (PEOP), but you cannot overwrite PEOP. If you encounter PEOP, the tape drive reacts as if it encountered the physical end of the tape (PEOT). The write operation stops and any buffered data is not written to tape.

Locating Data Blocks in Partitions

Use the READ POSITION (34h) command to identify the position of a specific data block on a partitioned tape as you would on a standard tape. The READ POSITION data returned by the tape drive indicates the block address at the current location. It also indicates the number of the partition the tape is located in.

When you use the LOCATE (2Bh) command on a partitioned tape, first specify which partition the tape drive should search for the requested block. If you need to change partitions, set the CP (Change Partition) bit to 1. Then, specify the number of the partition you want the tape moved to in the Partition field. The tape drive moves the tape to the requested partition, then searches for the requested block.

Reading Data on a Partitioned Tape

To read data, use the READ (08h) command as you would with a standard tape. However, remember that if you want to read data in a partition the tape is not currently in, you must use the LOCATE or MODE SELECT command to reposition the tape to that partition. After you have issued a command to relocate to a new partition, you can use a LOCATE command or SPACE command to move the tape to a legal position for reading data.

Rewinding a Partitioned Tape

When you issue a REWIND (01h) command, the tape drive rewinds the tape to the beginning of the current partition. If the tape is positioned in the first partition, the tape drive rewinds the tape to the logical beginning of the tape (LBOT).

If you want to rewind to LBOT and the tape is positioned in a partition other than the first, do not use the REWIND command. Instead, use the LOCATE command to position the tape to the beginning of the first partition (LBOT).

Erasing a Partitioned Tape

The ERASE command acts on only one partition at a time. After erasing the partition, the tape drive rewinds the tape to the beginning of that partition. To erase the data from an entire tape without eliminating the partitions, you must erase each partition separately.

Erasing Data From One Partition   If you want to erase the data from just one partition, use the ERASE command as you would with a standard tape. Start from the beginning of the partition you want to erase and issue the ERASE command. The tape drive rewrites the LBOP information, erases forward from LBOP, stops at the end of the partition, then rewinds to LBOP. When you erase the data from one partition, no data in other partitions is erased.

Erasing the Entire Tape   If you want to erase the entire tape, you can erase each partition separately and preserve the partition information. Or, you can reformat the tape as a single-partition tape, then erase the entire tape.

> ➤ **Important**   When you reformat a multi-partition tape to create a single-partition tape, all of the information defining the original partitions is erased. However, the data on the tape is not erased. For this reason, if you are concerned about data remaining on a tape, do not use reformatting as a way to erase data. You must explicitly perform an erase operation to erase the data.

Unloading a Partitioned Tape

The UNLOAD command works exactly as it would for a standard tape. You can issue the UNLOAD command from any partition. The tape drive rewinds the tape to the physical beginning of tape (PBOT), unloads the tape from the tape path, and ejects the cartridge.

2.7 Handling Unit Attention Conditions

The tape drive creates a Unit Attention condition for each initiator when any of the following conditions occurs:

- A data cartridge is inserted and automatically loaded.

- A data cartridge is inserted and rejected because the media is incompatible with the tape drive.

- The unload button is pressed and the data cartridge is ejected.

- The MODE SELECT parameters are changed by an initiator other than the one attempting to communicate with the tape drive.

- The tape drive is reset (see page 2-18).

- A log parameter (counter) reaches a specified threshold value — assuming that the Report Log Exception Condition (RLEC) bit on the MODE SELECT Control Mode page is set to 1.

- The internal microcode (firmware) is changed by a SCSI download (WRITE BUFFER command).

Effect of Changing Data Cartridges

After you press the unload button, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h) to the first command it receives. Then, it returns Check Condition status with the sense key set to Not Ready (2h) to all subsequent commands that require tape motion.

Note: If you press the unload button and a data cartridge is loaded, the tape drive will unload the tape. It then returns Check Condition status with the sense key set to Unit Attention (6h) to the first command it receives during the unload procedure. Finally, it returns Check Condition status with the sense key set to Not Ready (2h) to all subsequent commands that require tape motion.

When you insert a data cartridge into the tape drive, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h). However, if you insert a data cartridge and autoloading is prevented (that is, autoload was disabled with a MODE SELECT command and a LOAD (1Bh) command was not received), the tape drive returns Check Condition status with the sense key set to Not Ready (2h).

Clearing the Unit Attention Condition

The Unit Attention condition persists for each initiator until that initiator issues any command other than INQUIRY (12h) or REQUEST SENSE (03h).

First Command Received after Unit Attention

If the first command received after a Unit Attention condition occurs is an INQUIRY or REQUEST SENSE command, the tape drive executes the command, reports any pending status, and preserves the Unit Attention sense data. If the first command is any other command, the tape drive does not execute the command and returns Check Condition status with the sense key set to Unit Attention (6h).

Next Command Received after Unit Attention

If the next command received after a Unit Attention is reported is a REQUEST SENSE or an INQUIRY command, the tape drive executes the command and preserves the Unit Attention sense data. If the next command is any other command, the command is executed and the Unit Attention sense data is cleared.

Note: If multiple Unit Attention conditions occur before the initiator selects the tape drive, only the sense data for the latest Unit Attention condition is presented.

2.8 Resetting the Tape Drive

You can use any of the following methods to reset the tape drive:

- Power the tape drive off and back on again (*power-on reset*).

- After a servo or hardware error, press and hold the unload button for approximately 10 seconds to clear the error and reset the tape drive. (Then, if necessary, wait a few seconds and press the button again to eject the tape.)

- Send a RST pulse on the SCSI bus for a minimum of 25 µsec (*SCSI bus reset*). A SCSI bus reset immediately clears all devices from the bus, resets their associated equipment, and terminates all pending I/O processes.

- Issue a Bus Device Reset (0Ch) message to the tape drive (*device reset*). A device reset clears the tape drive from the bus, causes all commands sent to it to be cleared, and terminates all pending I/O processes.

Note: If a SCSI bus or device reset occurs during a power-on reset, the power-on reset will be restarted.

Effect of Power-on Reset

Performing a power-on reset causes the tape drive to complete its power-on self-test. A power-on reset also has the following effects:

- If the tape drive is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.

- A cyclic redundancy check (CRC) of the control code is performed.

- The servo is reset and a servo self-test is performed.

- All tape drive parameters are reset to their default states.

- A test of the microprocessor's external memory is performed.

- A buffer memory test is performed.

After a power-on reset, the tape drive will respond on the SCSI bus within three seconds.

Effect of SCSI Bus and Device Resets

If the tape drive is set for buffered operation (see page 9-9) and there is data in the buffer from a WRITE or WRITE FILEMARKS command, the tape drive writes the buffered data to tape before resetting. Then, if the tape drive is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase. After a SCSI bus or device reset, the tape drive will respond on the SCSI bus within 250 msec.

Note: If the device that supplies SCSI bus terminator power is powered off, the RST line is left in an indeterminate state (either reset or not, depending on the voltages). It may be impossible to communicate with the tape drive or to unload a data cartridge when the device is in this state. To remove the data cartridge, restore power to the terminating device or remove the SCSI cable from the tape drive to allow independent tape drive operation.

Reset Processing

The tape drive processes resets differently depending on whether a data cartridge is present or not.

Data Cartridge Present before Reset

If a data cartridge is present before the reset occurs and the tape is not partitioned, the tape drive rewinds the tape and positions it at LBOT. If the tape is partitioned, the tape drive rewinds the tape then positions it at LBOP of the default partition (the last partition on the tape) or the partition specified by the LPART field of the last MODE SELECT command (see). When the reset is complete, the tape drive is ready to process tape motion commands.

When a data cartridge is present, the tape drive responds to the reset as follows:

- It returns Check Condition status to the first command received. The sense key is set to Unit Attention (6h), and the Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ) fields indicate that a reset occurred.

- It processes all non-motion commands. The default status returned by the TEST UNIT READY (00h) command is Check Condition status with the sense key set to Not Ready (2h). The ASC and ASCQ fields indicate that the device is becoming ready.

- If it receives tape motion commands, the tape drive queues (holds) one tape motion command from each initiator (and disconnects, if allowed) until the reset operation is complete and the tape is loaded. Once the load is complete, it processes the queued commands.

If the tape is already rewound when the reset occurs, the reset takes about one minute to complete. Additional time is required if the tape drive needs to rewind the tape.

Data Cartridge Not Present before Reset

When a data cartridge is not present, the tape drive responds to the reset as follows:

- It returns Check Condition status to the first command received. The sense key is set to Unit Attention (6h), and the ASC and ASCQ fields indicate that a reset occurred.

- It processes all non-motion commands. The TEST UNIT READY (00h) command returns Check Condition status with the sense key set to Not Ready (2h). The ASC and ASCQ fields indicate that no tape is present.

- It returns Check Condition status to all tape motion commands. The sense key is set to Not Ready (2h), and the ASC and ASCQ fields indicate that no tape is present.

> ➤ **Important** After a reset, do not insert a cartridge into the tape drive until all three LEDs are off. If you try to insert a cartridge before the LEDs are off, the tape drive will eject the cartridge.

Notes

3 ERASE (19h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	0	1
01	Logical Unit Number			Reserved			Immed	Long
02	Reserved							
03								
04								
05	Vendor Unique		Reserved				0	0

3.1 About This Command

The ERASE command causes the tape drive to erase all tape from the current valid tape position to the physical end of tape (PEOT) or, if the tape is partitioned, to the physical end of the current partition (PEOP).

When the erase operation is successfully completed, the tape is automatically rewound to the logical beginning of tape (LBOT) or, if the tape is partitioned, to the logical beginning of the current partition (LBOP).

The ERASE command performs the erase operation at the same speed as the READ and WRITE commands are performed.

Notes:

- The tape drive erases data written in Mammoth format only. It does not erase data written in 8200, 8500, or 8500c format.

- If the ERASE command is received after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, buffered data, filemarks, and setmarks are written to tape before the erase operation is performed.

  If an error occurs during the writing of the data in the buffer to the tape, the tape drive returns Check Condition status and the erase operation is not performed.

- To erase all of the data from a partitioned tape without eliminating the partitions, you must erase each partition separately.

3.2   Field Definitions

Byte 01, Bit 1 – Immed

Determines when command status is returned to the initiator:

0 – Status is returned when the ERASE command is completed.
1 – Status is returned when the ERASE command is started.

If the buffer contains data from a previous WRITE command, the tape drive disconnects from the SCSI bus (if disconnect was enabled) and writes the data in the buffer to the tape.

- **If the Immed bit is set to 1,** the tape drive reconnects to the initiator when the write operation has been completed successfully. It then returns Good status and performs the erase operation.

- **If the Immed bit is set to 0**, the tape drive reconnects and returns status when the erase and rewind operations are complete.

Byte 01, Bit 0 – Long

Determines the amount of tape to be erased:

0 – An end of data (EOD) mark is written at the current tape position, as long as that position is legal for writing data. No data is erased.

1 – All tape will be erased from the current position to PEOP.

Byte 05, Bits 7 and 6 – Vendor Unique

Must be 0.

3.3   Tape Positioning

The following are the legal tape positions for an erase operation:

- LBOT or LBOP
- EOD mark
- BOT or EOT side of a long filemark
- BOT or EOT side of a setmark

Note: The tape drive can only erase data written in Mammoth format.

3.4 Exceptions and Error Conditions

The following exceptions and error conditions can occur with the ERASE command.

Write-Protected Data Cartridge

If you attempt to erase a data cartridge that is write protected, the tape drive returns Check Condition status with the sense key set to Data Protect (7h).

Illegal Request

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

- The ERASE command is issued from an illegal position.

- The data on the tape is written in a format that the tape drive will not erase (any format other than Mammoth).

- The tape is not an AME tape.

4 INQUIRY (12h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Logical Unit Number			Reserved				EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	Vendor Unique		Reserved				0	0

4.1   About This Command

The INQUIRY command requests that information about the tape drive's parameters be sent to the initiator.

4.2   Field Definitions

Byte 01, Bit 0 – EVPD (Enable Vital Product Data)

Indicates the type of inquiry data being requested by the initiator, as follows:

0 – Standard Inquiry Data

1 – One of the Vital Product Data pages, based on the value of the Page Code field (byte 02)

Byte 02 – Page Code

Specifies the page number of the Vital Product Data page to be returned to the initiator, as follows:

00h – Supported Vital Product Data page
80h – Unit Serial Number page

If the EVPD bit (byte 1, bit 0) is set to 0, the Page Code must be 00h.

Byte 04 – Allocation Length

Specifies the number of bytes that the initiator has allocated for the return of inquiry data.

The tape drive terminates the Data In phase when the number of bytes specified in the Allocation Length field has been transferred or when all available inquiry data has been transferred, whichever is less.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for these bits must be 0.

Returning Inquiry Data

Table 4-1 summarizes the values you should specify to return the different types of inquiry data.

Table 4-1   Values to specify for the return of different types of inquiry data

To return this inquiry data...	Set these fields to...		And specify this value for the Allocation Length...	Number of bytes returned (hex)
	EVPD	Page Code		
Standard Inquiry Data	0	00h	any value from 0 to FFh	0 to 106 bytes (0h to 6Ah)
Supported Vital Product Data Page	1	00h	06h	6 bytes (06h)
Unit Serial Number Page	1	80h	0Eh	14 bytes (0Eh)

4.3   Standard Inquiry Data

The tape drive returns the Standard Inquiry Data when the EVPD bit in the CDB is 0.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	RMB	Device-Type Modifier						
02	ISO Version		ECMA Version			ANSI Version		
03	AENC	TrmIOP	Reserved		Response Data Format			
04	Additional Length							
05	Reserved							
06								
07	RelAdr	WBus32	WBus16	Sync	Linked	RSVD	CmdQue	SftRe
08 ⋮ 15	Vendor Identification							
16 ⋮ 31	Product Identification							
32 ⋮ 35	Product Revision Level							
36 ⋮ 55	Vendor Specific							
56 ⋮ 95	Reserved							
96 ⋮ 105	Unit Serial Number							

Byte 00 – Peripheral Qualifier and Peripheral Device Type

The Peripheral Qualifier (byte 00, bits 7 through 5) and the Peripheral Device Type field (byte 00, bits 4 through 0) identifies the device currently connected to the logical unit, as follows:

01h – The device currently connected to the logical unit is a sequential access device.

7Fh – The LUN is invalid (the LUN in the CDB or in the Identify message was not 0).

Byte 01, Bit 7 – RMB

The value returned for this field is 1, which indicates that the media is removable.

Byte 01, Bits 6 through 0 – Device-Type Modifier

The tape drive does not support the Device-Type Modifier. The value for this field is 0.

Byte 02, Bits 7 and 6 – ISO Version

The value returned for this field is 0h, which indicates that the tape drive does not claim compliance with the International Standardization Organization (ISO) version of SCSI.

Byte 02, Bits 5 through 3 – ECMA Version

The value returned for this field is 0h, which indicates that the tape drive does not claim compliance with the European Computer Manufacturers Association (ECMA) version of SCSI.

Byte 02, Bits 2 through 0 – ANSI Version

The value returned for this field is 2h, which indicates that the tape drive supports the current version of the ANSI SCSI-2 standard (X3T9.2/89-042).

Byte 03, Bit 7 – AENC

The value returned for this field is 0, which indicates that the tape drive does not have asynchronous event notification capability.

Byte 03, Bit 6 – TrmIOP

The value returned for this field is 0, which indicates that the tape drive does not support the Terminate I/O Process message.

Byte 03, Bits 3 through 0 – Response Data Format

The value returned for this field is 2h, which indicates that the data found is in accordance with the ANSI SCSI-2 standard.

Byte 04 – Additional Length

The value returned for this field is 65h, which indicates that there are 101 additional bytes of Inquiry data available to be returned.

Byte 07, Bit 7 – RelAdr

The value returned for this field is 0, which indicates that the tape drive does not support relative addressing.

Byte 07, Bit 6 – WBus32

The value returned for this field is 0, which indicates that the tape drive does not support 32-bit-wide bus transfers.

Byte 07, Bit 5 – WBus16

The value returned for this field indicates whether the tape drive supports 16-bit-wide bus transfers, as follows

0 – The tape drive does not support 16-bit-wide bus transfers (narrow SCSI configurations of Mammoth).

1 – The tape drive does support 16-bit-wide bus transfers (wide SCSI configurations of Mammoth).

Byte 07, Bit 4 – Sync

The value returned for this field is 1, which indicates that the tape drive supports synchronous data transfer.

Byte 07, Bit 3 – Linked

The value returned for this field is 0, which indicates that the tape drive does not support linked commands.

Byte 07, Bit 1 – CmdQue

The value returned for this field is 0, which indicates that the tape drive does not support tag command queuing.

Byte 07, Bit 0 – SftRe

The value returned for this field is 0, which indicates that the tape drive does not support the soft reset alternative in response to a reset condition.

Bytes 08 through 15 – Vendor Identification

Contains the ASCII representation of "EXABYTE", followed by a single space.

Bytes 16 through 31 – Product Identification

Contains the ASCII representation of the product name followed by the default configuration identifier (for example, EXB-8900MH000105). The first 8 bytes indicate the product line. The second 8 bytes identify the EEPROM image.

Bytes 32 through 35 – Product Revision Level

Contains the ASCII representation of the revision level (for example, "1000" or other Exabyte revision levels).

Bytes 36 through 55 – Vendor Specific

Contains the ASCII representation of blanks.

Bytes 96 through 105 – Unit Serial Number

Contains the ASCII representation of the tape drive's serial number in the format *dddddddddd*, where *d* is a decimal digit (0-9). For example, 0000000123 represents serial number 123.

4.4   Supported Vital Product Data Page

The tape drive returns the Supported Vital Product Data page when the EVPD bit in the CDB is 1 and the Page Code is 0.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code							
02	Reserved							
03	Page Length							
04	First Page Code Supported							
05	Second Page Code Supported							

Byte 00, Bits 7 through 5 – Peripheral Qualifier

The value for this field is 0, indicating that this is a single LUN device.

Byte 00, Bits 4 through 0 – Peripheral Device Type

The value returned for this field is 01h, which identifies the tape drive as a sequential access device.

Byte 01 – Page Code

The Page Code for the Vital Product Data page is 00h.

Byte 03 – Page Length

The value returned for this field is 02h, which indicates that two additional bytes available, excluding this byte.

Byte 04 – First Page Code Supported

The value for this field is 00h, which indicates support for the Vital Product Data page.

Byte 05 – Second Page Code Supported

The value returned for this field is 80h, which indicates support for the Unit Serial Number page.

4.5 Unit Serial Number Page

The tape drive returns the Unit Serial Number page when the EVPD bit in the CDB is 1 and the Page Code is 80h.

Bit Byte	7	6	5	4	3	2	1	0
00	Device Type Code							
01	Page Code							
02	Reserved							
03	Page Length							
04 ⋮ 13	Unit Serial Number							

Byte 00 – Device Type Code

The value returned for this field is 01h, which identifies the tape drive as a sequential access device. If the LUN in the CDB is not 0, the value returned is 7Fh, which indicates that the LUN is invalid.

Byte 01 – Page Code

The value returned for this field is 80h, which is the Page Code for the Unit Serial Number page.

Byte 03 – Page Length

The value returned for this field is 0Ah, which indicates that there are 10 additional bytes available, excluding this byte.

Bytes 04 through 13 – Unit Serial Number

Contains the ASCII representation of the tape drive's serial number in the format *dddddddddd*, where *d* is a decimal digit (0-9). For example, 0000000123 represents serial number 123.

Notes

5 LOAD/UNLOAD (1Bh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	1
01	Logical Unit Number			Reserved				Immed
02	Reserved							
03								
04	Reserved					EOT	Re-Ten	Load
05	Vendor Unique		Reserved				0	0

5.1   About This Command

The LOAD/UNLOAD command causes the tape drive to load or unload the data cartridge.

During a load operation, the tape drive performs the following actions:

1. It loads the tape into the tape path. (If the tape is already loaded, the tape drive takes no action.)

    Note: The cartridge must be fully inserted into the tape drive when you issue the LOAD command. The LOAD command does not pull the cartridge into the tape drive.

2. If the tape is not partitioned, it positions the tape to the logical beginning of tape (LBOT). If the tape is partitioned, it positions the tape to the default partition or to the partition specified by the MODE SELECT command (see the discussion about loading partitioned tapes on).

During an unload operation, the tape drive performs the following actions:

1. If necessary, it writes any data in the buffer to tape and writes the end of data (EOD) mark.

2. It rewinds the tape to the physical beginning of tape (PBOT).

3. It unloads the tape from the tape path.

4. It ejects the data cartridge as long as ejection has not been prevented by a PREVENT MEDIUM REMOVAL command (see Chapter 10).

Using the LOAD/UNLOAD Command on a Partitioned Tape

When the tape you are using is formatted with partitions, the LOAD/UNLOAD command performs as follows.

Loading a Partitioned Tape

The LOAD command positions the tape to the beginning of partition 0 (the last partition on the tape) by default, unless, before loading the tape, you specify a different partition using the LPART field of the MODE SELECT command (see page 9-50). Note that the LOAD command itself has no fields that specify to which partition the tape drive positions the tape.

Unloading a Partitioned Tape

The UNLOAD command unloads a partitioned tape just as it would a non-partitioned tape. You can issue the UNLOAD command from any partition. The tape drive rewinds the tape to PBOT, unloads the tape from the tape path, and ejects the cartridge (if ejection has not been prevented by a PREVENT MEDIUM REMOVAL command).

Tape Motion Command Received During Load Operation

When the tape drive receives tape motion commands during a load operation, it queues (holds) one tape motion command per initiator (and disconnects, if allowed) until the load operation is complete. Then it attempts to execute the queued command.

Note: If another initiator has reserved the tape drive for its exclusive use, the tape drive returns Reservation Conflict status.

5.2   Field Definitions

Byte 01, Bit 1 – Immed

Determines when command status is returned to the initiator:

0 – Status is reported when the load/unload operation is complete.
1 – Status is reported when the command is initiated by the tape drive.

If the buffer contains data from a previous WRITE command, the tape drive disconnects from the SCSI bus (if disconnect was enabled) and writes the data in the buffer to the tape.

- If the Immed bit is set to 1, the tape drive reconnects to the initiator when the write operation has been completed successfully. It then returns Good status and performs the load or unload operation.

  Note: Completing the write operation includes emptying the buffer and writing the EOD mark.

- If the Immed bit is set to 0, the tape drive reconnects and returns status when the load or unload operation is complete.

If an error occurs during the writing of the data from the buffer to the tape, the tape drive reconnects to the initiator and returns Check Condition status. The load or unload operation is not performed.

Byte 04, Bit 2 – EOT

This bit is ignored by the tape drive.

Byte 04, Bit 1 – Re-Ten

This bit is ignored by the tape drive.

Byte 04, Bit 0 – Load

Specifies which operation, load or unload, is to be performed:

0 – Unload operation.
1 – Load operation.

Table 5-1 indicates what action occurs based on the setting of the Load bit and the status of the data cartridge:

Table 5-1   Action occurring based on the Load bit and data cartridge status

If the Load bit is set to...	And the data cartridge is...	The following action occurs...
0	Out	No action.
1	Out	Check Condition status is returned with the sense key set to Not Ready (2h).
0	In	The data cartridge is unloaded.[a] If there is data in the write buffer, the data is written to tape. Then, the tape is rewound to PBOT and unloaded from the tape path, and the data cartridge is ejected from the tape drive.
1	In	The data cartridge is loaded and positioned at LBOT if the tape is not partitioned. If the tape is partitioned, the tape is positioned to the default partition (partition 0) or the partition specified by the MODE SELECT command, as explained on page 5-2. If the data cartridge is already loaded and there is data in the buffer, the data is written to the tape before the operation is performed.

[a] The unload operation is performed even if the PREVENT/ALLOW MEDIUM REMOVAL command was issued with the Prevent bit set to 1; however, the data cartridge is not ejected from the tape drive.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0.

6 LOCATE (2Bh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	0	1	0	1	1
01	Logical Unit Number			Reserved		BT	CP	Immed
02	Reserved							
03	(MSB)							
⋮			Block Address					
06								(LSB)
07	Reserved							
08	Partition							
09	Vendor Unique		Reserved				0	0

6.1   About This Command

The LOCATE command, in conjunction with the READ POSITION (34h) command, allows you to position the tape at a specified logical block address. During forward and backward locate operations, the tape drive moves the tape at its high-speed search speed.

Unlike space operations, locate operations do not detect filemarks and setmarks and do not return Check Condition status when these elements are encountered.

Using the LOCATE Command

To use the LOCATE command, follow these steps:

1. Determine the tape drive's current location by issuing a READ POSITION command (see Chapter 14).

2. In the initiator's memory, save the information returned for the First Block Location field (bytes 04 through 07) of the READ POSITION data.

3. Continue reading or writing data as required.

4. When you want to return to the previous location, issue a LOCATE command and specify the saved address in the Block Address field (bytes 03 through 06).

Notes:

- The LOCATE command is not supported for tapes written in 8200 format and will result in Check Condition status. The sense key will be set to Illegal Request (5h).

- If the disconnect option is enabled, the tape drive can disconnect from the initiator while the LOCATE command is executing.

- If the tape drive receives a LOCATE command after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, it writes any buffered data, filemarks, or setmarks to the tape before performing the locate operation.

  If an error occurs when the buffered data is being written, the tape drive returns Check Condition status and the locate operation is not performed.

Using the LOCATE Command on Partitioned Tapes

If the tape in the tape drive is formatted with partitions, you can use the LOCATE command to position the tape to a location within any partition. If necessary, the LOCATE command causes the tape drive to move from the current partition to another partition and then to find the requested block in the new partition. If an error occurs during this process, the tape is returned to the previous location in the original partition. (See Section 2.6 starting on page 2-11 for information about creating and using partitioned tapes.)

6.2   Field Definitions

Byte 01, Bit 2 – BT (Block Type)

Determines the type of block number contained in the Block Address field (bytes 03 through 06), as follows:

0 – SCSI logical block number, numbered sequentially from the beginning of the tape (or the beginning of the partition).

1 – Logical block number, not including setmarks. (This setting is not recommended for normal use.)

Byte 01, Bit 1 – CP (Change Partitions)

Determines whether the tape drive should move to the partition specified by the Partition field (byte 08) before positioning to the requested block, as follows:

0 – Ignore the Partition field. (Do not move the tape from the current partition.)

1 – Move to the partition specified in the Partition field.

Byte 01, Bit 0 – Immed

Determines when command status is returned to the initiator, as follows:

0 – Status is reported when the LOCATE command is completed.

1 – Status is reported when the LOCATE command is initiated by the tape drive.

If the tape drive buffer contains data from a previous WRITE command, the tape drive disconnects from the initiator (if disconnect was enabled) and writes the data to the tape before performing the locate operation.

- **If the Immed bit is set to 1**, the tape drive reconnects when the write operation has completed successfully. It then returns Good status and performs the locate operation.

  Note: Completing the write operation includes emptying the buffer to tape and writing the EOD mark.

- **If the Immed bit is set to 0**, the tape drive reconnects and returns status when the locate operation is complete.

Bytes 03 through 06 – Block Address

Indicates the address of the block that you want the tape drive to locate. This is the value returned for the First Block Address field in the READ POSITION data.

Byte 08 – Partition

Indicates which partition you want to move the tape to if the CP field (byte 01, bit 1) is set to 1 (change partitions), as follows:

n – Move to partition n, where n is a value from 0 to 63. Note that partitions are numbered consecutively from the *end* of the tape. Partition 0 is always the last partition on the tape.

The CP field must be set to 1 for the Partition byte to be in effect. If the CP field is 0, the tape drive ignores the Partition byte.

Byte 09, Bits 7 and 6 – Vendor Unique

Must be 0.

6.3 Exceptions and Error Conditions

The following exceptions and error conditions can occur with the LOCATE command.

EOD Detected

If the tape drive detects the end-of-data (EOD) mark during the locate operation, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Blank Check (8h)
Information bytes	If Valid= 1, indicate the difference between the requested logical position and the actual logical position.
ASC	00h
ASCQ	05h
FSC	33h

When the LOCATE command terminates, the logical tape position is after the last recorded data block, filemark, or setmark. Issue a READ POSITION command to determine the exact location.

PEOT or PEOP Encountered

During a locate operation, if the tape drive encounters the physical end of tape (PEOT) or the physical end of partition, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Medium Error (3h)
Information bytes	If Valid= 1, indicate the difference between the requested logical position and the last logical position detected.
ASC	00h
ASCQ	02h
PEOT	1
FSC	34h

When the LOCATE command terminates, the logical position is the last logical position the tape drive detected on tape.

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the locate operation, the tape drive terminates the LOCATE command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0
Sense Key	Medium Error (3h) or Hardware Error (4h)
Other bits and bytes	Depend on the error condition

When the LOCATE command is terminated, the position of the tape drive is the same as it was before the LOCATE command was issued.

Illegal Requests

The tape drive returns Check Condition status with the sense key set to Illegal Request (5h) if you attempt a locate operation on a tape written in 8200 format.

7 LOG SELECT (4Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	0
01	Logical Unit Number			Reserved			PCR	SP
02	PC		Reserved					
03 ⋮ 06	Reserved							
07	(MSB)							
08	Parameter List Length							(LSB)
09	Vendor Unique		Reserved				0	0

7.1 About This Command

The LOG SELECT command allows you to manage the tape drive's parameter values for write and read error recovery operations and the amounts of data compressed. You can set threshold and cumulative values and you can reset the values.

To test the tape drive, you can reset the parameters, perform the operations you want to test, then issue a LOG SENSE (4Dh) command to check the updated values (refer to Chapter 8 for information about the LOG SENSE command).

You can also specify if and when you want to be notified about changes to the parameters. For example, you might want the tape drive to return Unit Attention when a counter reaches its threshold value.

> ➤ **Important**   If you want the tape drive to return Unit Attention to notify you about changes to the parameters, first issue a MODE SELECT command and send the Control Mode page (Page Code= 0Ah) with the Report Log Exception Condition (RLEC) bit set to 1. Refer to Chapter 9 for more information.

Figure 7-1 shows the general structure of the LOG SELECT command. With each LOG SELECT CDB, you send a parameter list for each page on which you are changing values. Each parameter list has a Parameter List Header that indicates the number of bytes that follow the header as log parameters. You specify a log parameter for each value on the page that you want to change.
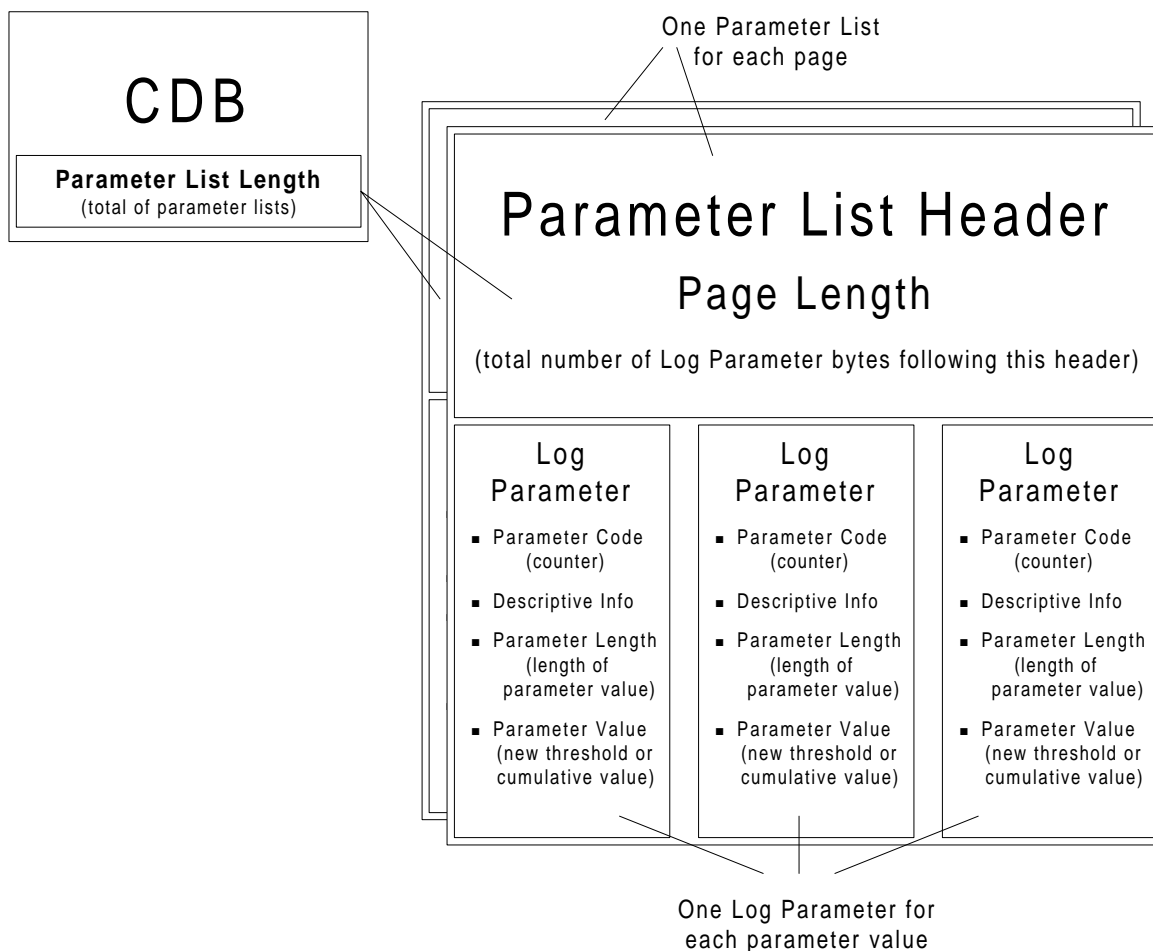
Figure 7-1   Relationship of log parameters and parameter lists to the LOG SELECT CDB

7.2　　Field Definitions

Byte 01, Bit 1 – PCR (Parameter Code Reset)

Indicates whether you want to reset some or all of the parameters, as follows:

0 – Reset some of the parameters only, as indicated by the PC field.

1 – Reset all of the parameters. Current cumulative values will be reset to 0, the Enable Threshold Comparison (ETC) bit will be reset to 0 (see page 7-9), and threshold values will be reset to all FFs.

Note: If you set the PCR bit to 1, be sure that the Parameter List Length is 0. Otherwise, the tape drive will return Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to CEh.

Byte 01, Bit 0 – SP (Save Parameters)

The tape drive does not support the save parameters function. The value for this bit must be 0.

Byte 02, Bits 7 and 6 – PC (Page Control)

If the PCR bit is 0, specifies what kind of values the tape drive should use to set the parameters. If the PCR bit is 1, this bit is ignored. Valid values are as follows:

00b – Set threshold values for the parameters listed in the parameter list.

01b – Set current cumulative values for the parameters listed in the parameter list.

10b – Set all threshold values to their default threshold values (all FFs). Set the ETC bit to 0 (see page 7-9).

11b – Set all current cumulative values to 0.

Note: If you set the PC field to 10b or 11b, be sure that the Parameter List Length is 0. Otherwise, the tape drive will return Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to CEh.

Bytes 07 and 08 – Parameter List Length

Indicates the number of bytes in the parameter lists that the initiator will send during the Data Out phase. The Parameter List Length must equal the sum of the lengths for each log parameter plus four bytes for each Parameter List Header. If a parameter list is transferred, it must be transferred in its entirety.

Valid values for this field are 0 to FFh (0 to 255). If the Parameter List Length is 0, no data is transferred.

Note: If the Parameter List Length is greater than 0, the PCR bit must be 0. Otherwise, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h, and the Fault Symptom Code set to CEh.

Byte 09, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0. Table 7-1 summarizes the valid settings for the PCR, PC, and Parameter List Length fields in the LOG SELECT CDB.

Table 7-1 Valid combinations of values for the fields in the LOG SELECT CDB

To set...	Set the PCR bit to...	Set the PC field to...	Set the Parameter List Length to...
Specified parameters to new threshold values	0	00b	The number of bytes in the parameter lists (from 0 to 255)
Specified parameters to new cumulative values	0	01b	
All parameters to default threshold values (do not reset cumulative values)	0	10b	0
All parameters to default cumulative values (do not reset threshold values)	0	11b	
All cumulative parameters to 0, all thresholds to FFs, and ETC to 0	1	ignored	

7.3   Parameter List Header

The Parameter List Header is sent during the Data Out phase before the log parameters. More than one Parameter List Header can be sent with each LOG SELECT command.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02	(MSB)		Page Length					
03								(LSB)

Field Definitions

Byte 00, Bits 5 through 0 – Page Code

Indicates the code of the log parameter page you want to modify. Only one page can be modified for each Parameter List Header. Valid page codes are the following:

02h – Write Error Counters page
03h – Read Error Counters page
39h – Data Compression page

Note: Do not specify page codes 2Eh (Tape Alert page), 35h (Tape History Log page), 3Ch (Drive Usage Information page), or 3Eh (Drive Temperature page) in the LOG SELECT command. You cannot change or reset the parameters on these pages.

Bytes 02 and 03 – Page Length

Indicates the number of bytes that follow as log parameters.

Note: The Page Length plus four bytes (for the Parameter List Header) equals the number of bytes in the parameter list. The sum of the bytes in all the parameter lists must equal the value specified for the Parameter List Length in the CDB.

7.4   Log Parameters

Zero or more log parameters follow the Parameter List Header. Each log parameter includes four bytes of descriptive information followed by a variable-length parameter value. There is no required order for the log parameters.

The format of a log parameter is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				
01								(LSB)
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length							
04	(MSB)							
...				Parameter Value				
nn								(LSB)

Bytes 00 and 01 – Parameter Code

Specifies the parameter for which you want to set the threshold or cumulative value. The definition of the parameter depends on which log parameter page you specified in the Parameter List Header.

The following tables describe the parameters for the supported pages:

- Table 7-2 lists the parameters for the Write Error Counters page.
- Table 7-3 lists the parameters for the Read Error Counters page.
- Table 7-4 lists the parameters for the Data Compression page.

Table 7-2   Parameter Code values for the Write Error Counters page

**Parameters for the Write Error Counters page**			
Parameter Code	**Parameter name**	**Description**	**Length (bytes)**
0002h	Total Rewrites	Indicates the number of physical blocks (1,012 bytes) the tape drive rewrote because they contained errors detected during read-after-write operations. Only user data blocks and short filemark blocks are ever rewritten. **Note:** Each time the tape drive performs a rewrite operation, it rewrites two physical blocks. One or both of the blocks may have had errors. This counter represents only the number of blocks that were in error, not the total number rewritten. This counter is equivalent to the Total Errors Corrected counter. Thresholds, threshold criteria, and cumulative values always use these counters and reflect the last set value.	3
0003h	Total Errors Corrected	Contains the same value as the Total Rewrites counter.	3
0004h	Total Times Errors Processed	Contains 0 since this is a read function only (write errors are rewritten). The default value is 0 and will never change.	3
0005h	Total Bytes Processed	Indicates the number of bytes successfully written to the tape. This counter only includes user data bytes, the gap bytes in user data blocks, and the bytes in short filemark blocks. Rewritten data is not counted.	5
0006h	Total Unrecoverable Errors	Indicates the number of times the tape drive could not write a block (1,012 bytes) to the tape.	2

Table 7-3   Parameter Code values for the Read Error Counters page

Parameters for the Read Error Counters page			
Parameter Code	**Parameter name**	**Description**	**Length (bytes)**
0002h	Total Rereads	Indicates the number of times the tape drive moved the tape backward to reread a portion of tape because a block (1,012 bytes) was missed.	3
0003h	Total Errors Corrected	Indicates the total number of blocks (1,012 bytes) the tape drive recovered either by using the ECC algorithm or by successfully rereading the block.	3
0004h	Total Times Errors Processed	Contains the same value as the Total Errors Corrected counter.	3
0005h	Total Bytes Processed	Indicates the number of user data bytes transferred from tape to the tape drive's buffer. Rewritten data is not counted.	5
0006h	Total Unrecoverable Errors	Indicates the number of blocks (1,012 bytes) the tape drive could not read after exhausting all retries.	2

Table 7-4   Parameter Code values for the Data Compression page

Parameters for the Data Compression page			
Parameter Code	**Parameter name**	**Description**	**Length (bytes)**
0005h	KB of Data Transferred to Data Compressor	Indicates the amount of data, in KB, that was compressed during a write operation.	6
0007h	KB of Data Transferred to Tape	Indicates the amount of compressed data, in KB, that was written to tape.	6

Byte 02, Bit 7 – Disable Update (DU)

Indicates whether updates to the current cumulative value are enabled or disabled, as follows:

0 – The tape drive can update the current cumulative value, so comparisons of the current cumulative value and the threshold value can occur normally.

1 – The tape drive will not update the current cumulative value, so threshold conditions will not be met for this parameter.

> ➤ **Important**   If you want the tape drive to compare the current cumulative value to the threshold value for the parameter and to return Unit Attention when the threshold criteria are met, first issue a MODE SELECT command and send the Control Mode page (Page Code= 0Ah) with the RLEC bit set to 1. Then, set the DU bit to 0 and the ETC bit to 1.

Byte 02, Bit 6 – Disable Save (DS)

This bit is ignored by the tape drive.

Byte 02, Bit 5 – Target Save Disable (TSD)

This bit is ignored by the tape drive.

Byte 02, Bit 4 – Enable Threshold Comparison (ETC)

Indicates whether threshold comparisons for the parameter are enabled or disabled, as follows:

0 – Threshold comparisons for this parameter are disabled.
1 – Threshold comparisons are performed on this parameter.

If threshold comparisons are enabled, the tape drive compares the cumulative value to the threshold value when the cumulative value is updated. When the conditions specified by the Threshold Met Criteria (TMC) bit are met, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h), the ASC and ASCQ set to 5Bh and 01h, and the Fault Symptom Code set to CAh.

Byte 02, Bits 3 and 2 – Threshold Met Criteria (TMC)

Specifies the conditions under which the tape drive will generate a Unit Attention (6h) sense key when comparing the current cumulative value to the threshold value. Threshold comparisons are made when the cumulative value is updated.

00b – Return Unit Attention when the cumulative value is updated

01b – Return Unit Attention when the updated cumulative value equals the threshold value

10b – Return Unit Attention when the updated cumulative value is not equal to the threshold value

11b – Return Unit Attention when the updated cumulative value is greater than the threshold value

Byte 02, Bit 0 – List Parameter (LP)

Must be 0. (List parameters are not supported.)

Byte 03 – Parameter Length

Indicates the length of the threshold or cumulative value in bytes. See the tables starting on page 7-7 for the length of each parameter value.

Note: You can specify any value from 0 to FFh for the Parameter Length field. If you specify 0 for the Parameter Length, the Parameter Value will be set to 0.

Bytes 04 to *nn* – Parameter Value

Indicates either a new threshold value or a new current cumulative value for the parameter, depending on the value you specified for PC in the CDB. The length of the value is defined by the Parameter Length field.

▪ **If the parameter value you specify is shorter than the actual length,** the tape drive pads the value with zeros from the parameter length to the most significant byte. That is, if you specify 8h for the parameter value and the length is two bytes, the tape drive pads the value to 0008h.

- **If the parameter value you specify is longer than the actual length,** all extra bytes between the actual length and the most significant byte of the Parameter Value must be 0. That is, if the length is two bytes, specifying FFFFFFh for the value would be an error, specifying 00FFFFh would not.

You can specify any value for the parameter from 0 to all FFs.

7.5   Exceptions and Error Conditions

The following exceptions and error conditions can occur with the LOG SELECT command.

Illegal Page Code in Parameter List Header

If you specify an illegal Page Code, such as 3Ch or 3Eh, in the Parameter List Header, the tape drive returns Check Condition status with a sense key of Illegal Request (5h) and an FSC of CEh.

Illegal Value in LOG SELECT Data

If one of the bytes sent with the LOG SELECT data contains an illegal value or if a reserved bit is set, the tape drive returns Check Condition status. To determine where the error is, issue a REQUEST SENSE command. The sense key will be set to Illegal Request (5h) and the sense key specific data (bytes 15 through 17 of the sense data) will indicate the exact location of the error.

Other Errors

The tape drive may return the Fault Symptom Codes (FSC) listed in Table 7-5 when thresholds are implemented.

➤ **Important** If you want the tape drive to return these Fault Symptom Codes to notify you about changes to the parameters, first issue a MODE SELECT command and send the Control Mode page (Page Code= 0Ah) with the RLEC bit set to 1. Refer to Chapter 9 for more information. In addition, be sure to set the DU bit to 0 and the ETC bit to 1 for the log parameter.

Table 7-5 REQUEST SENSE data for LOG SELECT errors and exceptions

FSC	Sense Key	ASC	ASCQ	Description
CAh	6h	5Bh	01h	**Unit Attention.** Threshold met. (For additional information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)
CBh	6h	2Ah	02h	**Unit Attention.** Log parameter changed.
ECh	1h	5Bh	02h	**Recovered Error.** Log parameter overflow (a cumulative parameter reached its maximum value of all FFs). When this occurs, the parameter stays at its maximum, the DU bit is set to 1 to disable updates, and the tape drive returns this Fault Symptom Code. This Fault Symptom Code indicates that the tape drive completed the command with no error. Check Condition status is returned only to alert the initiator that a parameter reached its maximum.

8 LOG SENSE (4Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	1
01	Logical Unit Number			Reserved			PPC	SP
02	PC		Page Code					
03	Reserved							
04								
05	(MSB)							
06	Parameter Pointer							(LSB)
07	(MSB)							
08	Allocation Length							(LSB)
09	Vendor Unique		Reserved				0	0

8.1   About This Command

The LOG SENSE command enables you to retrieve statistical
information about various tape drive parameter values. The tape drive
maintains the following pages of parameters:

- Supported Pages page (00h)
- Write Error Counters page (02h)
- Read Error Counters page (03h)
- Tape Alert page (2Eh)
- Tape History Log page (35h)
- Data Compression page (39h)
- Drive Usage Information page (3Ch)
- Drive Temperature page (3Eh)

The LOG SENSE data returned by the tape drive consists of a four-byte Parameter List Header and a log page. Each log page contains log parameter data blocks that provide information about the parameters.

Note: You can use the LOG SELECT (4Ch) command to specify cumulative and threshold parameter values or to reset the parameters on pages 00h, 02h, 03h, and 39h (see Chapter 7 for more information). You cannot set cumulative and threshold values or reset the parameters on pages 2Eh, 3Ch, and 3Eh.

8.2   Field Definitions

Byte 01, Bit 1 – PPC (Parameter Pointer Control)

The PPC bit specifies what type of parameters you are requesting from the tape drive. This bit must be 0, which indicates that the tape drive should return all parameters for the selected log page, beginning with the code in the Parameter Pointer filed (bytes 05 and o6).

Byte 01, Bit 0 – SP (Save Parameters)

The tape drive does not support the save parameters function. The value for this bit must be 0.

Byte 02, Bits 7 and 6 – PC (Page Control)

Indicates the type of parameter values you want the tape drive to return, as follows:

00b – **Return the current threshold values.** These values are reset to their default settings after a power-on reset, SCSI bus reset, or Bus Device Reset message.

01b – **Return the current cumulative values.** These values are the values that have accumulated since the last power-on reset, SCSI bus reset, Bus Device Reset message, or setting by a LOG SELECT command. When a parameter reaches its maximum value, it is returned as all FFs. (For example, FFFFFFh is returned as the maximum value for a three-byte parameter.)

10b – **Return the default threshold values.** The default threshold values cannot be changed. The values returned represent the maximum values each parameter can obtain (all FFs).

11b – **Return the default cumulative values.** The default cumulative values cannot be changed. The values returned represent the values that each parameter is reset to (whether by power-on reset, SCSI bus reset, Bus Device Reset message, or LOG SELECT reset). The default cumulative value for all parameters is 0.

Byte 02, Bits 5 through 0 – Page Code

Indicates which LOG SENSE page you want the tape drive to return. The type of data returned for the page depends on the value you specify for the PC field. The tape drive supports the following pages:

00h – **Supported Log Pages page.** This page lists the pages supported by the LOG SENSE command.

02h – **Write Error Counters page.** This page includes a log parameter data block for each write error counter.

03h – **Read Error Counters page.** This page includes a log parameter data block for each read error counter.

2Eh – **Tape Alert page.** This page reports information from the tape drive's internal Tape Alert firmware. This firmware constantly monitors the tape drive and the tape for errors and potential difficulties. When a problem is detected, the tape drive sets a flag on this page to identify the type of problem detected.

35h – **Tape History Log page.** This page reports statistics for the life of the tape currently loaded in the tape drive, including such information as number of blocks written, number of blocks read, and read and write retries.

39h – **Data Compression page.** This page reports the amount of data compressed or decompressed before and after read and write operations.

3Ch – **Drive Usage Information page.** This page reports tape drive lifetime totals for events such as the number of cartridge loads, number of blocks processed, power-on time, and cleaning cycles.

3Eh – **Drive Temperature page.** This page reports the most current temperature reading taken by the tape drive's internal sensor.

Bytes 05 and 06 – Parameter Pointer

Indicates the Parameter Code of the first parameter you want to be returned for the requested page. As long as the value in the Allocation Length field is large enough, the tape drive returns all parameters with a Parameter Code greater than or equal to the code specified in this field.

The parameters are returned in Parameter Code order (unsigned). If the parameter specified does not exist, the tape drive returns the next available parameter first.

Notes:

- If you set the Page Code field to 00h (Supported Log Pages page), this field is ignored.

- If the value for this field is greater than the Parameter Code for any of the parameters, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h), the ASC set to 24h, the ASCQ set to 00h, and the Fault Symptom Code set to CEh.

Bytes 07 and 08 – Allocation Length

Specifies the maximum number of bytes you want the tape drive to transfer during the Data In phase. You can specify any value from 0 to FFFFh.

Note: It is not error to specify a value for the Allocation Length field that would truncate the information on one of the pages.

Byte 09, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for these bits must be 0.

8.3   Parameter List Header

The four-byte Parameter List Header precedes each of the LOG SENSE pages. It specifies a page code and indicates the total length of the data to follow.

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	Page Code					
01	Reserved							
02	(MSB)							
03				Page Length				(LSB)

Byte 00, Bits 5 through 0 – Page Code

Identifies the type of LOG SENSE data being returned by the tape drive. The value returned for this field equals the Page Code you specified in the CDB, as follows:

00h – Supported Log Pages page
02h – Write Error Counters page
03h – Read Error Counters page
2Eh – Tape Alert page
35h – Tape History Log page
39h – Data Compression page
3Ch – Drive Usage Information page
3Eh – Drive Temperature page

Bytes 02 and 03 – Page Length

Indicates the total number of bytes that will follow this byte if the Allocation Length specified in the CDB is sufficient. The value returned for this field depends on the value you specified for the Page Code and the Parameter Pointer in the CDB.

8.4 Supported Log Pages Page (Page Code= 00h)

The Supported Log Pages page is returned when the Page Code in the CDB is 00h. Unlike other LOG SENSE pages, no parameter information is returned on this page. Instead, the Supported Log Pages page lists the LOG SENSE pages supported by the tape drive. The page codes are listed in ascending order.

Bit Byte	7	6	5	4	3	2	1	0
00	Supported Log Pages Page Code							
01	Write Error Counters Page Code							
02	Read Error Counters Page Code							
03	Tape Alert Page Code							
04	Tape History Log Page Code							
05	Data Compression Page Code							
06	Drive Usage Information Page Code							
07	Drive Temperature Page Code							

Byte 00 – Supported Log Pages Page Code

The value returned for this field is 00h, which is the Page Code of the Supported Log Pages page.

Byte 01 – Write Error Counters Page Code

The value returned for this field is 02h, which is the Page Code of the Write Error Counters page.

Byte 02 – Read Error Counters Page Code

The value returned for this field is 03h, which is the Page Code of the Read Error Counters page.

Byte 03 – Tape Alert Page Code

The value returned for this field is 2Eh, which is the Page Code of the Tape Alert page.

Byte 04 – Tape History Log Page Code

The value returned for this field is 35h, which is the Page Code of the Tape History Log page.

Byte 05 – Data Compression Page Code

The value returned for this field is 39h, which is the Page Code of the Data Compression page.

Byte 06 – Drive Usage Information Page Code

The value returned for this field is3Ch, which is the Page Code of the Drive Usage Information page.

Byte 07 – Drive Temperature Page Code

The value returned for this field is 3Eh, which is the Page Code of the Drive Temperature page.

8.5 Log Parameters

The tape drive returns information about its log parameters immediately after it returns the Parameter List Header. For each parameter, the tape drive returns a data block that includes four bytes of descriptive information and a variable-length parameter value. The total number of bytes returned for each parameter is equal to the value for the Parameter Length field plus four.

The tape drive returns the log parameter data blocks for the specified LOG SENSE page in Parameter Code order (unsigned). The code for the first parameter will be equal to or greater than the value you specified for the Parameter Pointer field in the CDB.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				
01								(LSB)
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length							
04	(MSB)							
⋮				Parameter Value				
nn								(LSB)

Bytes 00 and 01 – Parameter Code

Identifies the code of the parameter for which the tape drive is returning a value. See the following sections for a list of the parameter codes for each page.

Byte 02, Bit 7 – DU (Disable Update)

Indicates whether updates to the current cumulative value for this parameter are enabled or disabled, as follows:

0 – The tape drive can update the current cumulative value, so comparisons between the current cumulative value and the threshold value occur normally.

1 – The tape drive will not update the current cumulative value, so threshold conditions will not be met for this parameter.

Byte 02, Bit 6 – DS (Disable Save)

Tape drive always returns 1 for this bit, indicating that the tape drive does not support the saving of log parameters.

Byte 02, Bit 5 – TSD (Target Save Disable)

The value for the Target Save Disable bit indicates whether the tape drive provides a self-defined method for saving log parameters, as follows:

0 – The tape drive provides a self-defined method for saving the current cumulative value for this counter. The counter is not reset when the tape drive is reset.

1 – The tape drive does not support saving the current cumulative value for this counter. The counter is reset when the tape drive is reset.

Byte 02, Bit 4 – ETC (Enable Threshold Comparison)

Indicates whether threshold comparisons are enabled or disabled for this parameter:

0 – Threshold comparisons are disabled for this parameter.
1 – Threshold comparisons are performed on this parameter.

When threshold comparisons are enabled (and the DU bit is 0), the tape drive compares the current cumulative value to the threshold value for the parameter. When the conditions specified by the TMC bit are met, the tape drive returns Check Condition status with the sense key set to Unit Attention (6h), the ASC and ASCQ set to 5Bh and 01h, and the FSC set to CAh.

Threshold comparisons are made when the cumulative value is updated.

Byte 02, Bits 3 and 2 – TMC (Threshold Met Criteria)

Specifies the conditions under which the tape drive will generate a Unit Attention (6h) sense key when comparing the current cumulative value to the threshold value. Threshold comparisons are made when the cumulative value is updated. Valid values are as follows:

00b – Return Unit Attention when the cumulative value is updated

01b – Return Unit Attention when the updated cumulative value equals the threshold value

10b – Return Unit Attention when the updated cumulative value is not equal to the threshold value

11b – Return Unit Attention when the updated cumulative value is greater than the threshold value

> ➤ **Important** If you want the tape drive to return Unit Attention to notify you about changes to the parameters, first issue a MODE SELECT command and send the Control Mode page (Page Code= 0Ah) with the Report Log Exception Condition (RLEC) bit set to 1. Refer to Chapter 9 for more information.

Byte 02, Bit 0 – LP (List Parameter)

Tape drive always returns 0 for this bit, indicating that the tape drive does not support List Parameters.

Byte 03 – Parameter Length

Indicates the length of the threshold or cumulative value in bytes.

Bytes 04 to *nn* – Parameter Value

Lists either a threshold value or a cumulative value for the parameter, depending on what you specified for the PC field in the CDB.

Write Error Counters Page (Page Code= 02h)

When you specify 02h for the Page Code, the tape drive returns information about the parameters listed in Table 8-1.

Table 8-1 Parameters returned for LOG SENSE Write Error Counters page

Parameter Code	Parameter Name	Parameter Length (bytes)	Default Cumulative Value	Default Threshold Value
0002h	Total Rewrites	3	0	all FFs
0003h	Total Errors Corrected	3	0	all FFs
0004h	Total Times Errors Processed	3	0	all FFs
0005h	Total Bytes Processed	5	0	all FFs
0006h	Total Unrecoverable Errors	2	0	all FFs

Total Rewrites   Indicates the number of physical blocks (1,012 bytes) the tape drive rewrote because they contained errors detected during read-after-write operations. Only user data blocks and short filemark blocks are ever rewritten.

Note: Each time the tape drive performs a rewrite operation, it rewrites two physical blocks. One or both of the blocks may have had errors. This counter represents only the number of blocks that were in error, not the total number rewritten.

The Total Rewrites counter is equivalent to the Total Errors Corrected counter. Thresholds, threshold criteria, and cumulative values always use these counters and reflect the last set value.

Total Errors Corrected   Contains the same value as the Total Rewrites counter.

Total Times Errors Processed   Always 0 since this is only a read function (write errors are rewritten).

Total Bytes Processed   Contains the number of bytes successfully written to the tape. This counter only includes user data bytes, the gap bytes in user data blocks, and the bytes in short filemark blocks. Rewritten data is not counted.

Total Unrecoverable Errors   Contains the number of times the tape drive could not write a block (1,012 bytes) to the tape.

Read Error Counters Page (Page Code= 03h)

When you specify 03h for the Page Code, the tape drive returns information about the parameters listed in Table 8-2.

Table 8-2 Parameters returned for LOG SENSE Read Error Counters page

Parameter Code	Parameter Name	Length in bytes	Default Cumulative Value	Default Threshold Value
0002h	Total Rereads	3	0	all FFs
0003h	Total Errors Corrected	3	0	all FFs
0004h	Total Times Errors Processed	3	0	all FFs
0005h	Total Bytes Processed	5	0	all FFs
0006h	Total Unrecoverable Errors	2	0	all FFs

Total Rereads   Contains the number of times the tape drive moved the tape backward to reread a portion of tape because a block (1,012 bytes) was missed.

Total Errors Corrected   Contains the number of blocks (1,012 bytes) the tape drive recovered either by using the ECC algorithm or by successfully rereading the block.

Total Times Errors Processed   Contains the same value as the Total Errors Corrected counter.

Total Bytes Processed   Contains the number of user data bytes transferred from tape to the tape drive's buffer. Rewritten data is not counted.

Total Unrecoverable Errors   Contains the number of blocks (1,012 bytes) the tape drive could not read after exhausting all retries.

Tape Alert Page (Page Code= 2Eh)

The tape drive's internal Tape Alert firmware constantly monitors the tape drive and the tape for errors and potential difficulties. Any problems identified are flagged on the Tape Alert page. There are two methods of accessing this information:

- If Tape Alert is enabled using the MODE SELECT command (see Section 9.14), the tape drive returns a Recovered Error message to the initiator on the next SCSI command whenever one or more Tape Alert flags are set. A pending Recovered Error will be returned on the first successful SCSI command after the Tape Alert flag is set. The Tape Alert log page should be read immediately after the Recovered Error message is received.

  Note: The command which receives the Recovered Error message will have executed correctly and should not be reissued by the initiator.

- The host software can periodically read the Tape Alert log page to determine if any new flags have been set. If this method is used, the initiator should read the log page whenever any of the following occur:

  - Immediately after a SCSI Check Condition status followed by a REQUEST SENSE.

  - At the end of each tape when a job spans multiple tapes. If the data cartridge will be ejected, then the Tape Alert page must be read before the tape is unloaded.

  - At the completion of an operation.

  - Before a tape is unloaded.

  - At some regularly scheduled interval (for example, once a minute).

When you specify 2Eh for the Page Code, the tape drive returns the information about the parameters listed in Table 8-3. Each parameter is one byte long. The bit 0 contains the value for the flag, as follows:

0 – The flag is not currently set.
1 – The flag is currently set.

The remaining 7 bits of the flag are not used.

Note: Issuing a LOG SENSE command that returns this page resets all of the flags to 0. The flags are also reset whenever the tape drive is reset and by the condition indicated by the flag being corrected.

Table 8-3   Parameters returned for the LOG SENSE Tape Alert page

Parameter	Flag Name	Type[a]	Description
01h	Read	W	The tape drive is having problems reading data. No data has been lost, but there has been a reduction in the capacity of the tape.
02h	Write	W	The tape drive is having problems writing data. No data has been lost, but there has been a reduction in the capacity of the tape.
03h	Hard Error	W	A hard read/write error has occurred. The current operation has stopped because the tape drive cannot correct an error that occurred while the tape drive was reading or writing data.
04h	Media	C	Media performance is severely degraded. Your data is at risk. To safe guard the data on this tape, do the following: ■ Copy any data you want to preserve to another tape. ■ Do not use this tape again. ■ Restart the current operation using a different tape. **Note:** The Tape History Log (THL) option must be enabled in the tape drive's EEPROM.
05h	Read Failure	C	The tape drive can no longer read data from the tape. Either the tape is damaged or the tape drive is not operating correctly. ■ Try reading data from a known good tape. If you can read this tape, replace the damaged tape. ■ If the problem persists, contact Exabyte Technical Support.

Table 8-3   Parameters returned for the LOG SENSE Tape Alert page (*continued*)

Parameter	Flag Name	Type[a]	Description
06h	Write Failure	C	The tape drive can no longer write data to the tape. Either the tape is damaged or the tape drive is not operating correctly. ▪ Try reading data from a known good tape. If you can read this tape, replace the damaged tape. ▪ If the problem persists, contact Exabyte Technical Support.
07h	Media Life	W	The tape is past its specified life cycle. The data cartridge has reached the end of its useful life. ▪ Copy any data you want to preserve to another tape. ▪ Do not use this tape again. **Note:** The Tape History Log (THL) option must be enabled in the tape drive's EEPROM.
08h	Not Data Grade	W	The tape drive cannot read the MRS stripes on the tape. The tape is not data-grade. Any data you back up onto the tape is at risk. Replace the cartridge with one containing data-grade tape.
09h	Write Protect	C	The initiator attempted to write to a write-protected data cartridge. Remove the write protection or use another cartridge.
0Ah	No Removal	I	A data cartridge unload operation was attempted while the initiator was preventing media removal.
0Bh	Cleaning Media	I	A cleaning cartridge is currently in the tape drive. If you want to back up or restore, insert a data cartridge.
0Ch	Unsupported Format	I	The loaded tape contains data in an unsupported format.
0Dh	Snapped Tape	C	The data cartridge in the tape drive contains a broken tape. ▪ Discard the data cartridge. ▪ Restart the current operation with a different tape.
0Eh – 13h	Unassigned Read/Write condition	—	Not used.
14h	Clean Now	C	The tape drive needs cleaning. ▪ If the tape drive is not currently in use, eject any data cartridge and insert a cleaning cartridge to clean the tape drive. ▪ If the tape drive is in use, wait until the current operation is complete, then insert a cleaning cartridge to clean the tape drive.

Table 8-3   Parameters returned for the LOG SENSE Tape Alert page (*continued*)

Parameter	Flag Name	Type[a]	Description
15h	Clean Periodic	W	The tape drive needs to be cleaned at the next opportunity.
16h	Expired Cleaning Media	C	The cleaning cartridge that was inserted into the tape drive is used up. Use a new cleaning cartridge to clean the tape drive.
17h – 1Ch	Unassigned Cleaning Flag	—	Not used.
1Eh	Hardware A	C	The tape drive has a problem that is not read/write related. ▪ Reset the tape drive. ▪ Restart the operation. ▪ If the problem persists, contact Exabyte Technical Support.
1Fh	Hardware B	C	The tape drive has a problem that is not read/write related. ▪ Turn the tape drive off and then on again. ▪ Restart the operation. ▪ If the problem persists, contact Exabyte Technical Support.
20h	Interface	W	There is a problem in the SCSI interface between the initiator and the tape drive. ▪ Check all of the SCSI cables and connections. ▪ Restart the operation.
21h	Eject Media	C	The current operation has failed. ▪ Eject the current data cartridge, then reload it. ▪ Restart the operation.
22h	Download Fail	W	The last attempt to download new firmware has failed. Obtain the correct firmware and try again.
23h – 27h	Unassigned Hardware Failure		Not used.
28h – 31h	Library Error		Not used.
32h – 40h	Unassigned		Not used.

[a] I = Informational suggestion to user.
 W = Warning. Remedial action is advised. Performance of data may be at risk.
 C = Critical. Immediate remedial action is required.

Tape History Log Page (Page Code= 35h)

The values of the counters on this page are statistics from the life of the tape currently loaded in the tape drive. When a tape is loaded, these values are refreshed from the values found in the tape's Tape History Log (THL) entries. These numbers apply to the whole tape and are not specific to the current partition. If the cartridge is write protected, then the THL values on the tape and on this page will not be updated.

The values of these counters will not roll. If a counter reaches its maximum count, it remains at this value. Thus a 1 byte counter stops counting at FFh and will never roll back to zero. A counter is not likely to reach its maximum count before the tape exceeds its useful life.

Notes:

▪ The Tape History Log Page page is not supported by the LOG SELECT command. You cannot set thresholds for the parameters on this page or clear them.

▪ By default the Tape History Log page is disabled in the EEPROM. Enabling the Tape History Log page requires updating the EEPROM firmware.

▪ If the Tape History Log option is disabled, the Previous and Lifetime counters on this page, return 0. The Tape ID and Current counters will report normally.

When you specify 35h for the Page Code, the tape drive returns the information about the parameters listed in Table 8-6.

Table 8-4 Parameters returned for the LOG SENSE Tape History Log page

Parameter Code	Parameter Name	Length in bytes
01h	Tape ID	8
02h	Current Blocks Written	4
03h	Current Blocks Rewritten	4
04h	Current Blocks Read	4
05h	Current Blocks ECC'd	4
06h	Current Write Retries	2
07h	Current Read Retries	2
08h	Current Tracking Retries	2

Table 8-4 Parameters returned for the LOG SENSE Tape History Log page (*continued*)

Parameter Code	Parameter Name	Length in bytes
09h	Current Data Underruns	2
0Ah	Current Data Overruns	2
0Bh	Current Rewinds	2
0Ch	Current Max Temperature	1
0Dh	Current Drive Serial Number	4
0Eh	Previous Blocks Written	4
0Fh	Previous Blocks Rewritten	4
10h	Previous Blocks Read	4
11h	Previous Blocks ECC'd	4
12h	Previous Write Retries	2
13h	Previous Read Retries	2
14h	Previous Tracking Retries	2
15h	Previous Data Underruns	2
16h	Previous Data Overruns	2
17h	Previous Rewinds	2
18h	Previous Max Temperature	1
19h	Previous Drive Serial Number	4
1Ah	Lifetime Blocks Written	5
1Bh	Lifetime Blocks Rewritten	5
1Ch	Lifetime Blocks Read	5
1Dh	Lifetime Blocks ECC'd	5
1Eh	Lifetime Write Retries	4
1Fh	Lifetime Read Retries	4
20h	Lifetime Tracking Retries	4
21h	Lifetime Data Underruns	4
22h	Lifetime Data Overruns	4
23h	Lifetime Rewinds	4
24h	Lifetime Max Temperature	1
25h	Lifetime Load Count	4
26h	Lifetime Maximum Tape Pass Count	4

Tape ID   Indicates the unique identifier for the tape currently loaded in the tape drive. The Tape ID is created the first time a blank tape is written. It is unaffected by all normal read and write activity, including the SCSI ERASE command. Reformatting a previously written tape will create a new Tape ID if the new format is different from the previous format. The 8-byte ID is derived from the serial number and lifetime load count of the tape drive that first wrote to the tape.

In the following parameters descriptions, the same counters appear in three different forms: Current, Previous, and Lifetime. The parameter begin accumulated in each counter is the same, regardless of whether it is Current, Previous, or Lifetime. The three forms of the counter are defined as follows:

- **Current** – Contains count values occurring since the current tape was loaded

- **Previous** – Contains count values from the last use of this tape

- **Lifetime** – Contains the count values accumulated over the entire lifetime of this tape, excluding the current load session.

    Note: The Lifetime values for the Block Written, Blocks Rewritten, Blocks Read, and Blocks ECC'd counters are internally scaled. Therefore the low order bits for values reported on this page may lose significance.

Blocks Written   A count of the total number of physical blocks written to tape.

Blocks Rewritten   A count of the total number of physical blocks rewritten to tape because of errors detected during the read-after-write operation.

Blocks Read   A count of the number of physical blocks the tape drive has read from tape. This number may exceed the number of blocks transferred to the hose due to read-ahead mechanisms used in read and search modes.

Blocks ECC'd   A count of the number of physical blocks read from tape which required error correction by the tape drive.

Write Retries   A counter that increments whenever a write operation is unsuccessful and a recovery/retry operation is performed.

Read Retries   A counter that increments whenever a read operation is unsuccessful and a recovery/retry operation is performed.

Tracking Retries   A counter that increments when a tracking error occurs during tape motion start-up.

Data Underruns   A counter that increments whenever the tape drive repositions the tape after encountering an empty data buffer during a write operation. This indicates that the initiator is not transferring data fast enough to maintain streaming operation.

Data Overruns   A counter that increments whenever the tape drive repositions the tape after encountering a full data buffer during a read operation. This indicates that the initiator is not transferring data fast enough to maintain streaming operation.

Rewinds   A count of the number of rewind operations performed by the tape drive.

Maximum Temperature   Indicates the highest temperature recorded by the tape drive's tape path temperature sensor. The value is reported in degrees Celsius.

Load Count   A cumulative count of the number of times this data cartridge has been loaded during its lifetime.

Lifetime Maximum Tape Pass Count   A counter that increments for each tape pass over the lifetime of the tape. When the count reaches 20,000 (4E20h), the tape drive sets parameter code 07h on the Tape Alert Log page (see Table 8-3).

Data Compression Page (Page Code= 39h)

When you specify 39h for the Page Code, the tape drive returns information about the parameters listed in Table 8-5.

Table 8-5   Parameters returned for LOG SENSE Data Compression page

Parameter Code	Parameter Name	Length in bytes	Default Cumulative Value	Default Threshold Value
0005h	KB of Data Transferred to Data Compressor	6	0	all FFs
0007h	KB of Data Transferred to Tape	6	0	all FFs

KB of Data Transferred to Data Compressor   Indicates the amount of data, in KB, that was compressed during a write operation.

KB of Data Transferred to Tape   Indicates the amount of compressed data, in KB, that was written to tape.

Drive Usage Information Page (Page Code= 3Ch)

When you specify 3Ch for the Page Code, the tape drive returns information about the parameters listed in Table 8-6. These parameters provide lifetime statistics for the tape drive. If a counter reaches its maximum value, it will remain at that value and not roll back to zero.

Note: The Drive Usage Information page is not supported by the LOG SELECT command. You cannot set thresholds for the parameters on this page or clear them.

Table 8-6 Parameters returned for LOG SENSE Drive Usage Information page

Parameter Code	Parameter Name	Length in bytes
0001h	Total Blocks Written	8
0002h	Total Blocks Rewritten	8
0003h	Total Blocks Read	8
0004h	Total ECC Corrections	8
0005h	Total Blocks Reread	8
0006h	Total Load Count	3
0007h	Minutes Since Last Clean	3
0008h	Minutes of Powered Time	3
0009h	Minutes of Tensioned Time	3
000Ah	Cleaning Count	2
000Bh	Vendor Unique	2
000Ch	Vendor Unique	2
000Dh	Vendor Unique	2
000Eh	Vendor Unique	2
000Fh	Vendor Unique	2
0010h	Vendor Unique	2
0011h	Time to Clean	1
0012h	Vendor Unique	1
0013h	reserved	3
0014h	reserved	3

Total Blocks Written Indicates the total number of physical blocks the tape drive has written to tape during its lifetime.

Total Blocks Rewritten Indicates the total number of physical blocks the tape drive has rewritten during its lifetime.

Total Blocks Read Indicates the total number of physical blocks the tape drive has read from tape during its lifetime.

Total ECC Corrections Indicates the total number of physical blocks the tape drive has read from tape that required ECC correction during its lifetime.

Total Blocks Reread Indicates the total number of physical blocks the tape drive has reread during its lifetime.

Total Load Count Indicates the total number of load cycles the tape drive's cartridge loader has performed during its lifetime.

Minutes Since Last Clean Indicates the number of tape motion minutes since the tape drive was last cleaned.

Minutes of Powered Time Indicates the total number of minutes the tape drive has been powered on during its lifetime.

Minutes of Tensioned Time Indicates the total number of minutes a tape has been tensioned in the tape path during the tape drive's lifetime.

Cleaning Count Indicates the total number of cleaning cycles the tape drive has undergone during its lifetime.

Time to Clean Bit 1 of this byte is always set to 1, indicating that the tape drive dynamically updates bit 0 of this byte. If bit 0 is set to 1, the tape drive needs to be cleaned.

Drive Temperature Page (Page Code= 3Eh)

When you specify 3Eh for the Page Code, the tape drive returns information about the parameters listed in Table 8-7.

Note: The Drive Temperature page is not supported by the LOG SELECT command. You cannot set thresholds for the Drive Temperature sensor or clear it.

Table 8-7 Parameters returned for LOG SENSE Drive Temperature page

Parameter Code	Parameter Name	Length in bytes
0001h	Drive Temperature	1

Drive Temperature Indicates the most recent temperature reading taken by the tape drive's internal sensor in degrees Celsius.

9 MODE SELECT (15h, 55h); MODE SENSE (1Ah, 5Ah)

6-Byte MODE SELECT (15h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	0	1
01	Logical Unit Number			PF	Reserved			SP
02	Reserved							
03								
04	Parameter List Length							
05	Vendor Unique		Reserved				0	0

10-Byte MODE SELECT (55h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	1	0	1	0	1
01	Logical Unit Number			PF	Reserved			SP
02 ⋮ 06	Reserved							
07	(MSB) Parameter List Length							
08								(LSB)
09	Vendor Unique		Reserved				0	0

6-Byte MODE SENSE (1Ah)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	0
01	Logical Unit Number			RSVD	DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	Vendor Unique		Reserved				0	0

10-Byte MODE SENSE (5Ah)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	1	1	0	1	0
01	Logical Unit Number			RSVD	DBD	Reserved		
02	PC		Page Code					
03 ⋮ 06	Reserved							
07	(MSB)		Allocation Length					
08								(LSB)
09	Vendor Unique		Reserved				0	0

9.1 About These Commands

The MODE SELECT command allows the initiator to specify medium, logical unit, and device parameters. The MODE SENSE command allows the tape drive to report these parameters to the initiator. These parameters apply to all initiators in a multi-initiator environment.

Both MODE SELECT and MODE SENSE are available as a 6-byte CDB (command descriptor block) and as a 10-byte CDB. When requesting all parameter pages, use the 10-byte version of the MODE SENSE command, if possible, to accommodate the future addition of pages.

The two versions of MODE SELECT and MODE SENSE have different operation codes (Op codes), as shown below.

	Op code for 6-byte CDB	Op code for 10-byte CDB
MODE SELECT	15h	55h
MODE SENSE	1Ah	5Ah

MODE SELECT and MODE SENSE parameters can be structured in either of two formats: *non-page format or page format.*

Non-Page Format

In non-page format, the parameters after the Block Descriptor are vendor unique (SCSI-1 format). The parameters are transferred in the following order:

- Parameter List Header
- Block Descriptor (optional)
- One to five bytes of vendor-unique parameters

Page Format

In page format, the parameters after the Block Descriptor are structured as pages of related parameters (SCSI-2 format). The parameters are transferred in the following order:

- Parameter List Header
- Block Descriptor (optional)
- One or more available pages of related parameters

9.2 Field Definitions for MODE SELECT

Byte 01, Bit 4 – PF (Page Format)

Indicates in which format the MODE SELECT parameters are specified:

0 – Parameters after the Block Descriptor are vendor specific (non-page format)

1 – Parameters after the Block Descriptor are structured as pages of related parameters (page format)

Byte 01, Bit 0 – SP (Saved Page)

The tape drive does not support the saved page function. The valid value for this bit is 0.

Byte 04 (6-Byte CDB) or
Bytes 07 and 08 (10-Byte CDB) – Parameter List Length

Indicates the total number of bytes to be transferred from the initiator to the tape drive.

For non-page format (PF= 0), the Parameter List Length can contain values ranging from 00h to 11h (for the 6-byte CDB) or from 00h to 15h (for the 10-byte CDB).

For page format (PF= 1), all parameters after the Block Descriptor are transferred as pages of parameters. To determine the Parameter List Length, total the number of bytes contained in the Parameter List Header, the Block Descriptor (if you are sending it), and all of the parameter pages you are sending. The maximum value you can specify is FFh (for the 6-byte CDB) or FFFFh (for the 10-byte CDB).

Note: When the value for the Parameter List Length is 0, no data is transferred from the initiator. A value of 0 is not an error.

Restrictions for sending MODE SELECT parameters:

- For non-page format, valid transfer lengths for the vendor-unique parameters are 0, 1, 2, 3, 4, and 5 bytes. All transfers of the vendor-unique parameters start with byte 0.

- For data transfers greater than 0 bytes, the entire Parameter List Header must be transferred before the Block Descriptor or any parameter page or vendor-unique parameters.

- The Block Descriptor and any parameter pages must be transferred in their entirety; partial transfers of these data segments are not allowed.

  Note: Any value for the Parameter List Length that causes the Parameter List Header, Block Descriptor, or one of the parameter pages to be truncated will terminate the command with Check Condition status. The sense key will be set to Illegal Request and the Additional Sense Code will be set to Parameter List Length Error.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The valid value for these bits is 0.

9.3   Field Definitions for MODE SENSE

Byte 01, Bit 3 – DBD (Disable Block Descriptor)

Indicates whether the initiator wants the Block Descriptor returned as part of the MODE SENSE parameter data:

0 – Send the Block Descriptor
1 – Do not send the Block Descriptor

Note: The DBD bit must be 0 if the Page Code is 0 (non-page format). Otherwise the tape drive returns Check Condition status with a sense key of Illegal Request (5h). When the Page Code is 0, use the Allocation Length field in the CDB to specify whether the Block Descriptor is returned.

Byte 02, Bits 7 and 6 – PC (Page Control)

Specifies the type of parameter values to be returned in the MODE SENSE data:

00b – Return the values set by the last successful MODE SELECT command or the power-on default values if a MODE SELECT command has not been executed since the last power-on reset, SCSI bus reset, or Bus Device Reset message

01b – Return all values that are changeable. The changeable values are indicated by 1s in each bit of each changeable field.

10b – Return the default values. (Values set in the EEPROM.)

11b – (Not supported.)

Note: This field is used only for page format and must be 00h for non-page format.

Byte 02, Bits 5 through 0 – Page Code

Specifies which MODE SENSE parameter page or pages the initiator is requesting. A value of 0 indicates that the parameters will be returned in non-page format.

Table 9-1 lists the valid values for the Page Code field.

Table 9-1   Values for the Page Code field in the MODE SENSE command

To return the parameters in...	Specify this Page Code...	This information will be returned...	Length
Non-page format	00h[a]	1 to 5 bytes of vendor-unique parameters	5 bytes
Page format	01h	Read-Write Error Recovery Page	12 bytes
	02h	Disconnect/Reconnect Page	16 bytes
	0Ah	Control Mode Page	8 bytes
	0Fh	Data Compression Page	16 bytes
	10h	Device Configuration Page	16 bytes
	11h	Medium Partition Page	136 bytes
	1Ch	Tape Alert Page	12 bytes
	20h	Vendor Unique Parameters Page 1	6 bytes
	21h	Vendor Unique Parameters Page 2	6 bytes
	3Fh	All available pages[b]	221 bytes

[a] If you specify 0 for the Page Code field, ensure that the DBD bit is also set to 0. Otherwise, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).

[b] When the Page Code is 3Fh, pages 01h through 21h are returned in the order listed in the table.

Byte 04 (6-Byte CDB) or Bytes 07 and 08 (10-Byte CDB) – Allocation Length

The Allocation Length indicates the amount of memory in bytes that the initiator has allocated for the return of MODE SENSE parameters. The Allocation Length can contain values ranging from 0 to FFh (for the 6-byte CDB) or from 0 to FFFFh (for the 10-byte CDB).

When the Page Code field is 0, the tape drive returns up to 17 bytes in response to the 6-byte CDB and up to 21 bytes in response to the 10-byte CDB. When the Page Code field is a non-zero value, the tape drive returns either one or all pages of related parameters plus the Parameter List Header and the Block Descriptor (if specified).

To determine the Allocation Length, total the number of bytes in the Parameter List Header, Block Descriptor (if you are requesting it), and all parameter pages you are requesting. Or, to receive all available data, specify FFh (for the 6-byte CDB) or FFFFh (for the 10-byte CDB).

Note: If the future addition of MODE SENSE pages results in more than FFh bytes of available data, using the 6-byte CDB may result in Check Condition status with the sense key set to Illegal Request when all pages are requested. For this reason, it is recommended that you use the 10-byte CDB.

If the Allocation Length is smaller than the amount of data available from the tape drive, the returned data is truncated. The tape drive returns Check Condition status with the sense key set to Illegal Request and the Additional Sense Code set to Parameter List Length Error. If the Allocation Length is greater than the amount of data to be returned, only the number of bytes available are transferred; no additional data is transferred.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for these bits must be 0.

9.4   Parameter List Header for MODE SELECT

The format of the Parameter List Header depends on which version of the MODE SELECT command you are using (6-byte or 10-byte CDB).

Parameter List Header, 6-Byte MODE SELECT

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02	RSVD	Buffered Mode			Speed			
03	Block Descriptor Length							

Parameter List Header, 10-Byte MODE SELECT

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02								
03	RSVD	Buffered Mode			Speed			
04	Reserved							
05								
06	(MSB) Block Descriptor Length							
07								(LSB)

Byte 02, Bits 6 through 4 (6-Byte CDB) or Byte 03, Bits 6 through 4 (10-Byte CDB) – Buffered Mode

The tape drive supports two data transfer modes:

000b – Unbuffered mode
001b – Buffered mode (power-on default)

In buffered mode, data from a WRITE command and filemarks or setmarks from a WRITE FILEMARKS command are held in the tape drive's buffer until one of the following events causes the data, filemarks, or setmarks to be written to the tape:

- The motion threshold is reached (see).

- The tape drive receives one of the following commands:

  - REWIND (01h)
  - WRITE FILEMARKS (10h) non-immediate
  - SPACE (11h) in either direction
  - ERASE (19h)
  - LOAD/UNLOAD (1Bh)
  - LOCATE (2Bh)

- The operator presses the unload button.

- The time specified for the Write Delay Time field in the Device Configuration Page elapses (note, however, if the Write Delay Time field is 0, a partially full buffer is not flushed to tape). See for more information about the Write Delay Time field.

- The tape drive receives a Bus Device Reset message or a SCSI bus reset occurs.

In buffered mode, status is returned when the last block of data has been transferred to the tape drive's buffer. In unbuffered mode, status is returned only after the data has actually been written to the tape.

Byte 02, Bits 3 through 0 (6-Byte CDB) or
Byte 03, Bits 3 through 0 (10-Byte CDB) – Speed

The tape drive does not support any operations at different speeds. All operations have a defined speed that cannot be modified by this command. The valid value for this field is 0.

Byte 03 (6-Byte CDB) or Bytes 06 and 07 (10-Byte CDB) – Block Descriptor Length

Contains the length of the Block Descriptor in bytes. The tape drive does not support multiple block descriptions. The valid values for this field are 00h (for no Block Descriptor) and 08h (for the entire Block Descriptor).

9.5 Parameter List Header for MODE SENSE

The format of the Parameter List Header depends on which version of the MODE SENSE command you are using (6-byte CDB or 10-byte CDB), as shown below.

Parameter List Header, 6-Byte MODE SENSE

Bit Byte	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Medium Type							
02	WP	Buffered Mode			Speed			
03	Block Descriptor Length							

Parameter List Header, 10-Byte MODE SENSE

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01	Mode Data Length							(LSB)
02	Medium Type							
03	WP	Buffered Mode			Speed			
04	Reserved							
05								
06	(MSB)							
07	Block Descriptor Length							(LSB)

Byte 00 (6-Byte CDB) or Byte 00 and Byte 01 (10-Byte CDB) – Mode Data Length

Indicates how many bytes of MODE SENSE data are available to be transferred, excluding this field. The value returned for this field is the remaining number of bytes in the Parameter List Header plus the number of bytes of data to be returned based on the field settings in the CDB.

Notes:

- For the 6-byte CDB, the Mode Data Length cannot exceed FFh. If the future addition of MODE SENSE pages results in more than FFh bytes of available data, using the 6-byte CDB may result in Check Condition status with the sense key set to Illegal Request when all pages are requested. For this reason, it is recommended that you use the 10-byte CDB.

- The value returned for the Mode Data Length does not reflect the value you specified for the Allocation Length in the CDB.

Byte 01 (6-Byte CDB) or Byte 02 (10-Byte CDB) – Medium Type

Represents the length of tape currently loaded in the tape drive. The values that can be returned are shown in Table 9-2.

Note: If the tape has not yet been sized, the tape drive will report the shortest of the possible lengths.

Table 9-2   Values returned for Medium Type field in MODE SENSE data

Value returned	Length of tape loaded
00h	No tape loaded, cleaning cartridge loaded, or tape unknown, broken, or unreadable
81h	15m (EXATAPE™ 15m)
82h	28m
83h	54m (EXATAPE 54m)
84h	80m
85h	106m
86h	160m (EXATAPE 160m XL)
C1h	22m (non-AME)

Table 9-2   Values returned for Medium Type field in MODE SENSE data (*continued*)

Value returned	Length of tape loaded
C2h	40m
C3h	76m
C4h	112m (EXATAPE 112m)
D1h	22m (EXATAPE 22m AME)
D2h	170m (EXATAPE 170m AME)

Byte 02, Bit 7 (6-Byte CDB) or Byte 03, Bit 7 (10-Byte CDB) – WP (Write Protect)

Indicates whether the data cartridge loaded in the tape drive is write protected:

0 – The data cartridge is not write protected.
1 – The data cartridge is write protected.

Byte 02, Bits 6 through 4 (6-Byte CDB) or Byte 03, Bits 6 through 4 (10-Byte CDB) – Buffered Mode

Indicates whether the tape drive buffers data during a write operation, as explained on :

000b – Unbuffered mode.
001b – Buffered mode. (Power-on default)

Byte 02, Bits 3 through 0 (6-Byte CDB) or Byte 03, Bits 3 through 0 (10-Byte CDB) – Speed

The tape drive does not support any operations at different speeds. All operations have a defined speed that cannot be modified. The valid value for this field is 0.

Byte 03 (6-Byte CDB) or Bytes 06 and 07 (10-Byte CDB) – Block Descriptor Length

This byte contains the length of the Block Descriptor in bytes. The tape drive does not support multiple block descriptions. The valid values for this field is 00h or 08h.

9.6　Block Descriptor

Bit Byte	7	6	5	4	3	2	1	0
00	Density Code							
01	(MSB)							
02	Number of Blocks							
03								(LSB)
04	Reserved							
05	(MSB)							
06	Block Length							
07								(LSB)

Byte 00 – Density Code

In the MODE SELECT command, the Density Code specifies the format the tape drive is to use to read or write data.

Because the Mammoth tape drive writes data in Mammoth format only, you do not need to change the Density Code to write data. When reading data, the tape drive automatically detects the format of the data on the tape and sets the Density Code accordingly. Therefore, you do not need to change the Density Code to read data.

If you need to send a Density Code to the tape drive, refer to Table 9-3 for the values you can use and their results.

Table 9-3   Values for the Density Code field in the MODE SELECT command

If you specify this Density Code...	The tape drive operates in this data format...	Notes
00h	Default format	You can use this Density Code at LBOT if you want to write or read in the default format (Mammoth format). If the tape is not at LBOT, the tape drive ignores this Density Code.
7Fh	No change in format	You can use this Density Code if you do not want to change the tape format. The format will remain the same as it was before the MODE SELECT command was sent to the tape drive. If the tape is not at LBOT you must use either 7Fh or the density code reported by the MODE SENSE command.
14h	8200 (read only)	You can use this Density Code at LBOT if you want to read 8200 format data. (Because the tape drive automatically senses the format of the data on the tape, you can also use 7Fh to read 8200 format data.) **Note:** This value is illegal for AME tapes.
15h	8500 (read only)	You can use this Density Code at LBOT if you want to read 8500 format data. (Because the tape drive automatically senses the format of the data on the tape, you can also use 7Fh to read 8500 format data.) **Note:** This value is illegal for AME tapes.
27h	Mammoth format	You can use this Density Code (or 00h) if you want to write or read Mammoth format. **Note:** You can set this value for a non-AME tape, but you cannot write Mammoth format data to a non-AME tape.
8Ch	8500c (read only)	You can use this Density Code at LBOT if you want to read 8500c format data. (Because the tape drive automatically senses the format of the data on the tape, you can also use 7Fh to read 8500c format data.) **Note:** This value is illegal for AME tapes.

Illegal density settings result in Check Condition status with a sense key of Illegal Request and an FSC of D7h.

In the MODE SENSE command, the Density Code indicates the current format the tape drive is using to read or write data (see Table 9-3 for the Density Code definitions).

As shown in Table 9-3, the value returned by the MODE SENSE command depends on the most recent activity.

If the most recent activity was a...	The value reported for the Density Code is the...		
	Format of the data on tape	Power-on default (27h), format of previous tape, or format set with last MODE SELECT	Power-on default (27h)
Power on (tape not loaded)		✔	
Load operation (tape written in recognizable format)	✔		
Load operation (blank tape or tape written in unrecognizable format)			✔
Tape positioned at any location other than LBOP	✔		
READ, SPACE, LOCATE, or VERIFY at LBOP	✔		
WRITE		✔	

Bytes 01 through 03 – Number of Blocks

In the MODE SENSE data, indicates the total capacity of the tape in approximately 16-KB physical units (LBOT to LEOT). This field is ignored in the MODE SELECT data.

Note: Use the Medium Partition Page (Page Code= 11h) to determine the capacity in MB of each of the partitions on the tape.

Bytes 05 through 07 – Block Length

Indicates the length in bytes of each logical block when the Fixed bit is set for the READ, WRITE, and VERIFY commands. When the Block Length is non-zero, fixed-length block operations are allowed. When the Block Length is 0, only variable-length block operations are allowed.

Note: If the Block Length is 0, the SILI bit of the READ command suppresses illegal length indications for both underlength and overlength reads. If the Block Length is non-zero, the SILI bit of the READ command suppresses illegal length indications only for blocks shorter than requested.

The power-on default value for the block length is 400h (1,024) bytes. The limit on the block length is the maximum block length specified by the Read Block Limits data (see Chapter 12).

9.7 Vendor-Unique Parameters (Non-Page Format)

Bit Byte	7	6	5	4	3	2	1	0
00	CT	RSVD	ND	RSVD	NBE	EBD	PE	NAL
01	Reserved							112m
02	Motion Threshold							
03	Reconnect Threshold							
04	Gap Threshold							

Byte 00, Bit 7 – CT (Cartridge Type)

This bit is ignored by the tape drive. (For EXB-8500 compatibility, this bit can be set to 0 or 1.)

Byte 00, Bit 5 – ND (No Disconnect During Data Transfer)

Indicates whether the tape drive can disconnect from the initiator during the data transfer phase, as follows:

0 – The tape drive can disconnect during the data transfer phase. (Power-on default)

1 – The tape drive will not disconnect until the data transfer phase has completed or the entire command has completed, as determined by the DTDC field in the Disconnect-Reconnect Page (see).

Byte 00, Bit 3 – NBE (No Busy Enable)

This bit is set to 1 (for EXB-8200 compatibility) in the MODE SENSE data and is ignored in the MODE SELECT command.

Byte 00, Bit 2 – EBD (Even Byte Disconnect)

Enables disconnects on even (4-byte) boundaries. This bit in the MODE command is ignored by the tape drive because the tape drive always disconnects on 4-byte boundaries between data phases. This bit can be set or reset for EXB-8500 compatibility. The value returned by the MODE SENSE command is 1.

Note: Even-byte disconnect applies only when more data is to be transferred for the current command. If no more data is to be transferred, a disconnect may occur on an odd-byte boundary.

Byte 00, Bit 1 – PE (Parity Enable)

Indicates whether parity checking on the SCSI bus is enabled, as follows:

0 – Parity checking disabled.
1 – Parity checking enabled. (Power-on default)

When PE= 1, every byte received by the tape drive is checked for parity.

Byte 00, Bit 0 – NAL (No Auto Load)

Indicates whether the automatic loading of the tape into the tape path is disabled when a data cartridge is inserted into the tape drive:

0 – Auto loading enabled. (Power-on default)
1 – Auto loading disabled.

Byte 01, Bit 0 – 112m

This bit is ignored by the tape drive. (For EXB-8500 compatibility, this bit can be set to 0 or 1.)

Byte 02 – Motion Threshold

Indicates the amount of data that must be in the buffer before tape motion is started for a buffered write or read operation. The value represents a percentage of the buffer space. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. The tape drive automatically adjusts this value (auto-thresholding) based on the data transfer rate of the host. See for more information about auto-thresholding and the Motion Threshold.

Note: The tape drive returns 00h for this field if auto-thresholding is enabled.

Byte 03 – Reconnect Threshold

Indicates the amount of data that must be in the buffer before the tape drive reconnects to the initiator for a buffered write or read operation. The value represents a percentage of the buffer space. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. By default, the tape drive automatically adjusts this value (auto-thresholding) based on the data transfer rate of the host. See for more information about auto-thresholding and the Reconnect Threshold.

Note: The tape drive returns 00h for this field if auto-thresholding is enabled.

Byte 04 – Gap Threshold

Specifies the maximum number of consecutive gap blocks that the tape drive will write on the current track while determining whether an empty buffer exists during a write operation. A gap block is a 1-KB block of undefined data that cannot be accessed by any SCSI command.

After writing the number of gap blocks specified by this byte, the tape drive will either continue the write operation (if there is new data in the buffer) or begin the process to stop tape motion (if the buffer is still empty). Before actually stopping tape motion, the tape drive writes additional gap blocks to complete the current track and then writes one or two complete gap tracks.

The Gap Threshold byte should be changed only when the average data transfer rate is slow and is impacting the capacity of the tape by forcing excessive start/stop activity. The Gap Threshold byte should be used in combination with the motion and reconnect thresholds described in this section.

Valid values for the Gap Threshold byte are 00h to FFh. The default value is 00h, which represents $7/8$ of a track (14 gap blocks). Any value greater than 07h is treated as 07h.

9.8 Read-Write Error Recovery Page (Page Code= 01h)

The Read-Write Error Recovery Page specifies error recovery parameters used during read-write operations.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved		TB	RSVD	EER	PER	DTE	DCR
03	Read Retry Count							
04 ⋮ 07	Reserved							
08	Write Retry Count							
09 ⋮ 11	Reserved							

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 01h (Read-Write Error Recovery Page).

Byte 01 – Page Length

Indicates the number of bytes in the Read-Write Error Recovery Page that follow this byte. The valid value is 0Ah.

Byte 02, Bit 5 – TB (Transfer Block)

The TB bit is not supported by the tape drive. The valid value is 0.

Byte 02, Bit 3 – EER (Enable Early Recovery)

The EER bit is not supported by the tape drive. The valid value is 0.

Byte 02, Bit 2 – PER (Post Error)

The PER bit is not supported by the tape drive. The valid value is 0.

Byte 02, Bit 1 – DTE (Disable Transfer on Error)

The DTE bit is not supported by the tape drive. The valid value is 0.

Byte 02, Bit 0 – DCR (Disable Correction)

The DCR bit is not supported by the tape drive. The valid value is 0.

Byte 03 – Read Retry Count

Specifies how many times the tape drive attempts its read recovery algorithms before an unrecoverable read error is reported. If the tape drive fails to reread the block after this number of attempts, it reports an unrecoverable error. You can set the Read Retry Count to any value between 00h and FFh. The default is 0Bh. Any value greater than 0Bh is automatically set to 0Bh.

The value you specify for the Read Retry Count determines what operation the tape drive performs when it encounters an unreadable data block, as follows:

- If you specified 00h for this byte, the tape drive does not attempt any rereads before reporting an unrecoverable read error and continuing with the read operation.

- If you specified 01h to 0Bh for this byte, the tape drive attempts its read recovery algorithm for either the default number of times or the number specified by this byte, whichever is smaller, before reporting an unrecoverable read error and continuing with the read operation.

Note: If you are reading a tape that may have been written without retries (see "Write Retry Count"), issue a MODE SENSE command and check the value returned for the WWR (Write Without Retries) bit in the Vendor Unique Parameters Page 2. If the WWR bit is set to 1, specify 0 for this field; otherwise, specify a non-zero value.

Byte 08 – Write Retry Count

Specifies how many times the tape drive should rewrite a physical block before a recovery is attempted. The value for this field can only be changed when the tape is positioned at LBOT. You can set the Write Retry Count to any value between 00h and FFh. The default value is 0Bh. Any value greater than 0Bh is automatically set to 0Bh.

Specify 00h for this field to set the Write Retry Count to 0. Specify any other nonzero value to set the Write Retry Count to 0Bh. A value of 00h for the Write Retry Count indicates that the tape drive will not rewrite any physical blocks during a write operation and will continue to write additional data. If a value of 00h is used, the tape drive may not be able to recover the data written on the tape since its write integrity cannot be guaranteed. The tape drive does not stop the write operation. Instead it writes Gap Blocks when no data blocks are present.

Note: If this field was set to 00h when the tape was written, the WWR (Write Without Retries) bit in the MODE SENSE Vendor Unique Parameters Page 2 will be set to 1, and you should set the Read Retry Count byte to 0 when reading the tape.

9.9 Disconnect-Reconnect Page (Page Code= 02h)

The Disconnect-Reconnect Page specifies parameters for tape drive disconnects and reconnects during data transfers.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Buffer Full Ratio							
03	Buffer Empty Ratio							
04	(MSB)							
05			Bus Inactivity Limit					(LSB)
06	(MSB)							
07			Disconnect Time Limit					(LSB)
08	(MSB)							
09			Connect Time Limit					(LSB)
10	(MSB)							
11			Maximum Burst Size					(LSB)
12	Reserved				DImm	RSVD	DTDC	
13	Reserved							
14								
15								

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 02h (Disconnect-Reconnect Page).

Byte 01 – Page Length

Indicates the number of bytes in the Disconnect-Reconnect Page that follow this byte. The valid value is 0Eh.

Byte 02 – Buffer Full Ratio

Indicates the amount of data that must be present in the buffer during a buffered read operation before the tape drive will attempt to reconnect to the initiator. The value represents a percentage of the buffer space. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. By default, the tape drive automatically adjusts this value (auto-thresholding) based on the data transfer rate of the host.

The Buffer Full Ratio must equal the Buffer Empty Ratio. If these values are not equal, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).

Byte 03 – Buffer Empty Ratio

Represents how empty the buffer must be during a buffered write operation before the tape drive will attempt to reconnect to the initiator. The value represents a percentage of the buffer space. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. By default, the tape drive automatically adjusts this value (auto-thresholding) based on the data transfer rate of the host.

The Buffer Empty Ratio must equal the Buffer Full Ratio. If these values are not equal, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).

Note: The Buffer Full Ratio and the Buffer Empty Ratio are equivalent to the Reconnect Threshold byte in the vendor-unique parameters (non-page format). See page 2-6 for information about auto-thresholding and the Reconnect Threshold.

Bytes 04 and 05 – Bus Inactivity Limit

Indicates the maximum amount of time in 100-microsecond increments that the tape drive can assert a BSY signal without a REQ/ACK handshake. When this time is exceeded, the tape drive can disconnect if not restricted by the DTDC field. The only supported value is 00h, which means that there is no time limit and the tape drive will disconnect as soon as it can.

Bytes 06 and 07 – Disconnect Time Limit

Indicates the minimum amount of time in 100-microsecond increments that the tape drive must wait after going bus free before attempting reselection. A value of 00h means that there is no time limit and the tape drive can reselect immediately upon bus free. The power-on default is 00h.

Bytes 08 and 09 – Connect Time Limit

Indicates the maximum amount of time that the tape drive can use the SCSI bus before it must disconnect. This value must be 00h, meaning that there is no time limit.

Bytes 10 and 11 – Maximum Burst Size

Defines the amount of data, in 512-byte increments, that the tape drive can transfer before it must disconnect. The tape drive supports all values for this field. The default is 0, which means that there is no limit.

Byte 12, Bit 3 – DImm (Disconnect Immediate)

Indicates whether the tape drive will attempt to disconnect immediately after every Command phase, as follows:

0 – The tape drive may attempt to disconnect after a Command phase, based on the setting of the DiscPriv bit in the Identify message and the settings of the other parameters on this page.

1 – The tape drive will attempt to disconnect after a Command phase if allowed and if internal processing would result in extended bus idle time. (Power-on default)

Byte 12, Bits 1 and 0 – DTDC (Data Transfer Disconnect Control)

When the ND bit is set to 1 (see page 9-46), the value of DTDC determines how disconnects are performed, as follows:

00b – Disconnects are not controlled by the DTDC field. Disconnects are controlled by the other fields on this page. (Power-on default)

01b – Once the data transfer of a command has started, the tape drive should not disconnect until all of the data has been transferred. The Maximum Burst Size (bytes 10 and 11) must be set to 0.

10b – Not valid.

11b – Once the data transfer of a command has started, the tape drive should not disconnect until the command is complete. The Maximum Burst Size (bytes 10 and 11) must be set to 0.

Note: The settings of the DTDC and ND fields are linked. If you change the setting of one, the other will be set accordingly.

9.10 Control Mode Page (Page Code= 0Ah)

The Control Mode Page specifies whether the tape drive returns Check Condition status when one of its write and read error counters reaches a specified threshold. For information about using the LOG SELECT command to set threshold values for the tape drive's write and read error counters, refer to Chapter 7.

Bit Byte	7	6	5	4	3	2	1	0
00	RSVD		Page Code					
01	Page Length							
02	RSVD							RLEC
03	Queue Algorithm Modifier				Reserved		QErr	DQue
04	EECA	Reserved				RAENP	UAAENP	EAENP
05	Reserved							
06	(MSB)	Ready AEN Holdoff Period						
07								(LSB)

Byte 00, Bits 5 through 1 – Page Code

Identifies the page being transferred. The valid value is 0Ah (Control Mode Page).

Byte 01 – Page Length

Indicates the number of bytes in the Control Mode Page that follow this byte. The valid value is 06h.

Byte 02, Bit 0 – RLEC (Report Log Exception Condition)

Indicates whether the tape drive returns Check Condition status with the sense key set to Unit Attention (6h) when one of its write and read error counters reaches a specified threshold, as follows:

0 – Do not return Unit Attention when a threshold condition is met.
1 – Return Unit Attention when a threshold condition is met.

Byte 03, Bits 7 through 4 – Queue Algorithm Modifier

The tape drive does not support the Simple Queue Tag message. The valid value for this field is 0.

Byte 03, Bit 1 – QErr (Queue Error)

The tape drive does not support the Simple Queue Tag message. The valid value for this field is 0.

Byte 03, Bit 0 – DQue (Disable Queuing)

The tape drive does not support the Simple Queue Tag message. The valid value for this field is 1.

Byte 04, Bit 7 – EECA (Enable Extended Contingent Allegiance)

The tape drive does not support extended contingent allegiance. The valid value for this bit is 0.

Byte 04, Bit 2 – RAENP (Ready AEN Permission)

The tape drive does not support asynchronous event notification (AEN). The valid value for this bit is 0.

Byte 04, Bit 1 – UAAENP (Unit Attention AEN Permission)

The tape drive does not support asynchronous event notification. The valid value for this bit is 0.

Byte 04, Bit 0 – EAENP (Enable AEN Permission)

The tape drive does not support asynchronous event notification (AEN). The valid value for this bit is 0.

Bytes 06 and 07 – Ready AEN Holdoff Period

The tape drive does not support asynchronous event notification. The valid value for this field is 0.

9.11 Data Compression Page (Page Code= 0Fh)

The Data Compression Page enables you to turn data compression on or off at any position on the tape.

When Mammoth writes data to tape, the data is automatically compressed. Mammoth monitors the compression ratio and automatically switches between compressed and uncompressed format when necessary. For this reason, you should not need to turn compression on and off for individual logical blocks. However, you can use this page to turn data compression off for various data files if, for some reason, you do not want to compress them.

To turn compression off, send this page with the DCE bit set to 0. To turn compression back on, send this page with the DCE bit set to 1.

Bit Byte	7	6	5	4	3	2	1	0
00	RSVD		Page Code					
01	Page Length							
02	DCE	DCC	Reserved					
03	DDE	RED		Reserved				
04 ⋮ 07	(MSB) Compression Algorithm (LSB)							
08 ⋮ 11	(MSB) Decompression Algorithm (LSB)							
12 ⋮ 15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 0Fh (Data Compression Page).

Byte 01 – Page Length

Indicates the number of bytes in the Data Compression Page that follow this byte. The valid value is 0Eh.

Byte 02, Bit 7 – DCE (Data Compression Enable)

Enables or disables data compression, as follows:

0 – Data compression is disabled.
1 – Data compression is enabled.

Note: You can also use the Select Data Compression Algorithm field (byte 14 of the Device Configuration Page) to control data compression (see page 9-37). The value received last by the tape drive takes precedence.

The setting of the DCE bit remains in effect across all operations (rewinds, loads, and so forth) until you change it or you change the Select Data Compression Algorithm field.

Byte 02, Bit 6 – DCC (Data Compression Capable)

Indicates that the tape drive supports data compression. The value returned is 1. This bit is ignored in the MODE SELECT command.

Byte 03, Bit 7 – DDE (Data Decompression Enable)

When the tape drive reads compressed data from tape, it automatically decompresses the data before sending to the initiator. Data decompression is always enabled, so this bit must always be 1 (enable data decompression). Note that a value of 1 is valid for any tape format, compressed or not.

Byte 03, Bits 6 and 5 – RED (Report Exception on Decompression)

The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The valid value for this field is 0.

Bytes 04 through 07 – Compression Algorithm

Indicates which compression algorithm the tape drive will use to compress data from the initiator. The only currently supported for this field is 10h (compress data using the IDRC data compression algorithm). This is the only compression algorithm currently supported by the tape drive.

Bytes 08 through 11 – Decompression Algorithm

Indicates which decompression algorithm the tape drive will use when decompressing data from the tape. The only value currently supported for this field is 10h (decompress data using the IDRC data compression algorithm). This is the only decompression algorithm supported by the tape drive.

Note. Specifying a value other than 10h for this field causes the tape drive to return Check Condition status with the sense key set to Illegal Request (5h).

9.12 Device Configuration Page (Page Code= 10h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved			Page Code				
01	Page Length							
02	RSVD	CAP	CAF	Active Format				
03	Active Partition							
04	Write Buffer Full Ratio							
05	Read Buffer Empty Ratio							
06	(MSB)			Write Delay Time				
07								(LSB)
08	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
09	Gap Size							
10	EOD Defined			EEG	SEW	Reserved		
11	(MSB)							
12	Buffer Size at Early Warning							
13								(LSB)
14	Select Data Compression Algorithm							
15	Reserved							

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 10h (Device Configuration Page).

Byte 01 – Page Length

Indicates the number of bytes in the Device Configuration Page that follow this byte. The valid value is 0Eh.

Byte 02, Bit 6 – CAP (Change Active Partition)

If the loaded tape is partitioned, this bit indicates that you want to move the tape from the current partition to a new partition specified by the Active Partition byte (byte 03), as follows:

0 – Do not move the tape from the current partition. (The MODE SENSE data always returns this value.)

1 – Move the tape to the partition specified by the Active Partition byte.

If the CAP bit is set to 1, the tape drive positions the tape to the logical beginning of the new partition (LBOP) after receiving a tape motion command. If the partition specified by the Active Partition field is the same as the currently active partition, the tape drive rewinds to the beginning of the current partition.

Note: If the currently loaded tape does not contain partitions, the CAP bit must be 0.

Byte 02, Bit 5 – CAF (Change Active Format)

Indicates that the active format is to be changed as specified by the values in the Active Format field, as follows:

0 – Do not change active format. (The MODE SENSE data always returns this value.)

1 – Change active format.

Byte 02, Bits 4 through 0 – Active Format

Contains data that modifies the media format parameters. The bit definitions for the Active Format field are as follows:

4	3	2	1	0
Reserved		Gap Threshold		

Byte 02, Bits 2 through 0 – Gap Threshold   This field has the same function as the Gap Threshold in the Vendor Unique Parameters for non-page format and in Vendor Unique Parameters Page 1 for page format. See for a description of this field. The value received last by the tape drive takes precedence.

Valid values for the Gap Threshold byte are 00h to FFh. The default value is 00h. Any value greater than 07h is treated as 07h.

Byte 03 – Active Partition

In the MODE SELECT data, the Active Partition byte indicates the number of the new partition that the tape is to be moved to (if you have set the CAP bit to 1 to change the active partition). In the MODE SENSE data, the Active Partition byte indicates the number of the partition in which the tape is currently positioned, as follows:

n – Partition *n*, where *n* is a value from 0 through 63. Note that partitions are numbered consecutively from the *end* of the tape. Partition 0 is always the last partition on the tape.

Notes:

- If the tape is not partitioned, the Active Partition byte must be 0.

- If the CAP bit is 0, the tape drive ignores the Active Partition byte.

- If you specify a partition that does not exist, Check Condition status results with the sense key set to Illegal Request.

- If the tape drive is not ready, the value of the Active Partition byte returned in the MODE SENSE data may be invalid.

Byte 04 – Write Buffer Full Ratio

Represents the amount of data that must be present in the buffer during a buffered write operation before that data is written to the tape. The value represents a percentage of the buffer space. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. By default, the tape drive automatically adjusts this value (auto-thresholding) based on the data transfer rate of the host.

The Write Buffer Full Ratio must equal the Read Buffer Empty Ratio (see the following field). If these values are not equal, the tape drive returns Check Condition status with the sense key set to Illegal Request.

Note: The default value for this field depends on whether auto-thresholding is enabled.

Byte 05 – Read Buffer Empty Ratio

Represents how empty the buffer must be during a buffered read operation before additional data will be read from the tape. The value represents a percentage of the buffer space. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. By default, the tape drive automatically adjusts this value (auto-thresholding) based on the data transfer rate of the host.

Note: The default value for this field depends on whether auto-thresholding is enabled.

The Read Buffer Empty Ratio must equal the Write Buffer Full Ratio (see the previous field). If these values are not equal, the tape drive returns Check Condition status with the sense key set to Illegal Request.

Note: The Write Buffer Full Ratio and the Read Buffer Empty Ratio have the same function as the Motion Threshold in the Vendor Unique Parameters Page 1. If both the Device Configuration Page and the Vendor Unique Parameters Page 1 are sent, the value that is received last by the tape drive takes precedence. See page 2-6 for more information about auto-thresholding and the Motion Threshold.

Bytes 06 and 07 – Write Delay Time

If a WRITE command completes without transferring enough data to exceed the value specified for the Write Buffer Full Ratio, the value specified by the Write Delay Time field is used to determine the maximum amount of time, in units of 100 msec, that the data will remain in the buffer. When the time specified by Write Delay Time elapses, the data in the buffer is written to tape.

A value of 0 for this field indicates that a partially full buffer will not be flushed to tape until the tape drive receives a command that would otherwise flush the buffer (for example, REWIND, UNLOAD, SPACE, LOCATE, and so on).

The default value for this byte is 0. Valid values for this field are 0000h to FFFFh (approximately 1.8 hours maximum).

Byte 08, Bit 7 – DBR (Data Buffer Recovery)

The tape drive does not support the DBR bit. The valid value is 0.

Byte 08, Bit 6 – BIS (Block Identifier Supported)

Indicates that block IDs are written on the tape relative to each partition. This bit is set to 1 in the MODE SENSE data and is ignored by the tape drive in the MODE SELECT command.

Byte 08, Bit 5 – RSmk (Report Setmarks)

Specifies whether the tape drive returns Check Condition status when it encounters a setmark on the tape during read, verify, space block, or space filemark operations, as follows:

0 – Do not report setmarks (setmarks are ignored).
1 – Report setmarks (default setting).

If the RSmk bit is 1 and the tape drive encounters a setmark, it returns Check Condition status with the sense key set to No Sense (0h). The ASC and ASQ fields are set to 00h and 03h.

Note: If the tape format does not support setmarks (8500 format), the tape drive ignores this bit.

Byte 08, Bit 4 – AVC (Automatic Velocity Control)

The tape drive does not support the AVC bit. The valid value is 0.

Byte 08, Bits 3 and 2 – SOCF (Stop on Consecutive Filemarks)

The tape drive does not support the SOCF field. The valid value is 0.

Byte 08, Bit 1 – RBO (Recover Buffer Order)

The tape drive does not support the RBO bit. The valid value is 0.

Byte 08, Bit 0 – REW (Report Early Warning)

Indicates whether reporting of the early-warning condition (LEOT) during a read operation is enabled or disabled, as follows:

0 – Do not report early-warning condition for read operations (default setting).

1 – Report early-warning condition for read operations after completing the current READ command.

The early-warning condition is reported as a Check Condition status with the sense key set to No Sense. The EOM bit is set to 1 and the LBOT bit is set to 0 in the extended sense data.

Byte 09 – Gap Size

The tape drive does not support the Gap Size field. The valid value is 0.

Byte 10, Bits 7 through 5 – EOD Defined

The tape drive does not support the EOD field. The valid value is 0.

Byte 10, Bit 4 – EEG (Enable EOD Generation)

Indicates that the tape drive will generate an EOD mark. This bit is set to 1 in MODE SENSE and is ignored by the tape drive in the MODE SELECT command.)

Byte 10, Bit 3 – SEW (Synchronize at Early Warning)

Indicates that the tape drive will cause any buffered data to be written to the tape when the early-warning condition (LEOT) is detected during a write operation. This bit is set to 1 in the MODE SENSE command and is ignored by the tape drive in the MODE SELECT command.

Bytes 11 through 13 – Buffer Size at Early Warning

The tape drive does not support the Buffer Size at Early Warning field. The valid value is 0.

Byte 14 – Select Data Compression Algorithm

Enables or disables data compression, as follows:

0 – Data compression is disabled.
1 – Data compression is enabled.

Note: You can also use the DCE bit (byte 02, bit 7 of the Data Compression Page) to control data compression (see page 9-29). The value received last by the tape drive takes precedence.

The setting of the Select Data Compression Algorithm field remains in effect across all operations (rewinds, loads, and so forth) until you change it or you change the DCE bit.

9.13 Medium Partition Page (Page Code= 11h)

The Medium Partition Page enables you to format a tape containing up to 64 partitions. Partitions are numbered consecutively from the end of the tape with partition 0 always being the last partition on the tape.

Before formatting new partitions, you must position the tape at LBOT or at the logical beginning of an existing partition.

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code					
01	Page Length							
02	Maximum Additional Partitions							
03	Additional Partitions Defined							
04	FDP	SDP	IDP	PSUM		Reserved		
05	Medium Format Recognition							
06	Reserved							
07	Reserved							
08	(MSB) Partition Size (partition 0)							
09								(LSB)
10	(MSB) Partition Size (partition 1)							
11								(LSB)
12 ⋮ 133	Partition Size (Partitions 2 through 62)							
134	(MSB) Partition Size (partition 63)							
135								(LSB)

Byte 00, Bit 7 – PS (Parameters Savable)

The tape drive does not support saving the parameter data contained in this page. The valid value is 0.

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 11h (Medium Partition Page).

Byte 01 – Page Length

Indicates the number of bytes in the Medium Partition Page that follow this byte. The valid value is 86h.

Byte 02 – Maximum Additional Partitions

In the MODE SENSE data, indicates how many partitions in addition to the original partition (the entire tape) may be defined. The tape drive can support a total of 64 partitions, so the value returned for this byte is 3Fh (63). (This field is ignored by the tape drive in the MODE SELECT command.)

Byte 03 – Additional Partitions Defined

In the MODE SELECT data, indicates the number of partitions being defined in addition to the original partition (the entire tape). Valid values are from 00h through 3Fh (63). If this byte is set to 00h, the tape drive ignores the sizes for partitions 0 through 63 in the Partition Size fields (bytes 08 through 135).

In the MODE SENSE data, the value returned is one less than the number of partitions currently on the tape. For example, a value of 00h indicates the tape contains one partition (the entire tape).

Byte 04, Bit 7 – FDP (Fixed Data Partitions)

Specifies whether the tape drive should use its "fixed" definition of partitions to format the tape. The fixed definition is a single partition encompassing the entire tape.

0 – Do not format the tape. (A value of 0 is always returned in the MODE SENSE data.)

1 – Format the tape with one partition.

Byte 04, Bit 6 – SDP (Select Data Partitions)

Specifies whether the tape drive should format the tape based on a predefined partition size. This size is "hard coded" in the tape drive as 50 MB and cannot be changed.

0 – Do not format the tape. (A value of 0 is always returned in the MODE SENSE data.)

1 – Format the tape with $n+1$ partitions, where n is the number of partitions specified by the Additional Partitions Defined field. Ignore the partition sizes specified in the Partition Size fields. The size of each partition (other than partition 0) is automatically set to 50 MB.

Byte 04, Bit 5 – IDP (Initiator Defined Partitions)

Specifies whether the tape drive should format the tape based on the partition sizes provided in the Partition Size fields, as follows:

0 – Do not format the tape. (A value of 0 is always returned in the MODE SENSE data.)

1– Format the tape with $n+1$ partitions, where n is the number of partitions specified by the Additional Partitions Defined field. Partitions 1 through n are the sizes specified in the Partition Size fields. Partition 0 is the remainder of the tape.

Table 9-4 summarizes the results of all possible combinations of the FDP, SDP, and IDP bits.

Note: The FDP, SDP, and IDP bits are mutually exclusive. When one of these bits is set to 1, the others must be 0.

Table 9-4 Results of combinations of the FDP, SDP, and IDP bits in the Medium Partition Page

For these combinations...			These results occur...	
FDP	**SDP**	**IDP**	**When you specify no additional partitions (Additional Partitions Defined = 00h)...**	**When you specify additional partitions (Additional Partitions Defined = 01h through 3Fh)...**
0	0	0	The tape drive does not format the tape.	
0	0	1	The tape drive formats the tape with one partition (the entire tape).	The tape drive formats the tape with $n + 1$ partitions, where n is the number of partitions specified by the Additional Partitions Defined field. The sizes are determined by the Partition Size fields.
0	1	0	The tape drive formats the tape with one partition (the entire tape).	The tape drive formats a tape with $n + 1$ partitions, where n is the number of partitions specified by the Additional Partitions Defined field. The size of each partition is set to 50 MB.
0	1	1	Not supported.	
1	0	0	The tape drive formats the tape with one partition (the entire tape).	
1	0	1	Not supported.	
1	1	0		
1	1	1		

Byte 04, Bits 4 and 3 – PSUM (Partition Size Unit of Measure)

If you set IDP (Initiator Defined Partitions) to 1 and are defining additional partitions (Additional Partitions Defined = 01h through 3Fh), use the PSUM field to indicate the units you are using to specify the sizes of the additional partitions. The valid values for PSUM are:

00b – The partition size is specified in bytes.

01b – The partition size is specified in KB.

10b – The partition size is specified in MB. (A value of 10b is always returned in the MODE SENSE data.)

Notes:

- If you specify the partition size in bytes, the tape drive automatically sets the value to 1 MB. If you specify the partition size in KB, the tape drive rounds the value down to the nearest MB. (If the result is 0, the value is automatically set to 1 MB.)

- If you are defining no additional partitions (Additional Partitions Defined = 00h), the tape drive ignores the PSUM field.

- If you are not using the Partition Size field to specify the partition size (that is, FDP= 1 or SDP= 1), the tape drive ignores the PSUM field.

Byte 05 – Medium Format Recognition

Indicates the tape drive's ability to recognize the medium format and partition information when an unknown tape is loaded. The value returned for this field in MODE SENSE is 03h, indicating that the tape drive can recognize both medium format and partition information. This field is ignored by the tape drive in the MODE SELECT command.

Bytes 08 and 09, 10 and 11,... , 134, and 135 – Partition Size (Partition *n*)

When IDP= 1, the Partition Size fields specify the approximate amount of uncompressed data space that is available between the logical beginning of each partition (LBOP) and the logical end of each partition (LEOP) on the tape.

In the MODE SELECT data, the tape drive ignores the partition size for partition 0 because partition 0 is always the remainder of the tape after all other partitions have been formatted. Use the Partition Size fields for partitions 1 through *n* to specify the sizes of all other partitions you are creating. Specify the units for the Partition Size field in the PSUM field (byte 04, bits 4 and 3).

In the MODE SENSE data, if the tape contains just a single partition, the Partition Size (partition 0) field returns the approximate uncompressed capacity of the entire tape.

9.14 Tape Alert Page (Page Code= 1C)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Perf	Reserved			DExcpt	Test	RSVD	LogErr
03	Reserved			MRIE				
04 ○ 07	Interval Timer							
08 ○ 11	Report Count							

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 1Ch (Tape Alert Page).

Byte 01 – Page Length

Indicates the number of bytes in the Tape Alert Page that follow this byte. The valid value is 0Ah.

Byte 02, Bit 7 – Perf

Indicates whether informational exception operations that can cause delays are acceptable. The valid value for this bit is 0 (delays are acceptable).

Byte 02, Bit 3 – DExcpt (Disable Exception Reporting)

Determines how the tape drive handles the reporting informational exception operations, as follows:

0 – The tape drive reports informational exceptions using the method specified by the MRIE field.

1 – The tape drive disables all informational exception operations. The MRIE field is ignored (default setting).

Byte 02, Bit 4 – Test

Determines whether the tape drive generates false informational exception conditions, as follows:

0 – The tape drive does not generate any false informational exception conditions (default setting).

1 – The tape drive generates a false informational exception condition based on the MRIE and Interval Timer settings. The next SCSI command after the MODE SELECT command returns Check Condition status with sense key set to Unit Attention (6h). The ASC and ASCQ fields are set to 5Dh and FFh. The FSC is set to F0h. If both the Test and DExcpt bits are set to 1, then the MODE SELECT command will be rejected as an illegal request.

Byte 02, Bit 0 – LogErr

Indicates whether the tape drive logs informational exception conditions. The tape drive does not support the LogErr bit. The valid value is 0.

Byte 03, Bits 3 through 0 – MRIE

Indicates the method used by the tape drive to report informational exception conditions, as follows:

3 – The tape drive conditionally generates a Recovered Error. Whenever one or more Tape Alert flags are set, the tape drive returns Check Condition status with sense key set to Recovered Error (1h). The ASC and ASCQ fields are set to 5Dh and 00h; the FSC is set to F1h. A pending Recovered Error will be returned on the first successful SCSI command after the Tape Alert flag is set. The Tape Alert log page should be read immediately after the Recovered Error message is received.

> **Note:** The command which receives the Recovered Error message will have executed correctly and should not be reissued by the initiator.

Bytes 04 through 07 – Interval Timer

Indicates the number of times the tape drive reports the informational exception condition. The tape drive only reports the condition one time. The valid value for this field is 0.

Bytes 08 through 11 – Report Count

The tape drive does not support this field. The valid value is 0.

9.15 Vendor Unique Parameters Page 1 (Page Code= 20h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	CT	RSVD	ND	RSVD	NBE	EBD	PE	NAL
03	RTF			WTF			RSVD	112m
04	Motion Threshold							
05	Gap Threshold							

Byte 00, Bits 5 through 0 – Page Code

Indicates the page being transferred. The valid value is 20h (Vendor Unique Parameters Page 1).

Byte 01 – Page Length

Indicates the number of bytes in the Vendor Unique Parameters Page 1 that follow this byte. The valid value is 04h.

Byte 02, Bit 7 – CT (Cartridge Type)

This bit is ignored by the tape drive. (For EXB-8500 compatibility, this bit can be set to 0 or 1.)

Byte 02, Bit 5 – ND

Indicates whether the tape drive can disconnect from the initiator during the data transfer phase, as follows:

0 – The tape drive can disconnect during the data transfer phase. (Power-on default)

1 – The tape drive will not disconnect until either the data transfer phase has completed or the command has completed, as determined by the DTDC field in the Disconnect-Reconnect Page (see).

Note: The settings of the ND and DTDC fields are linked. If you change the setting of one, the other will be set accordingly.

Byte 02, Bit 3 – NBE (No Busy Enable)

This bit is set to 1 (for EXB-8200 compatibility) in the MODE SENSE data and is ignored by the tape drive in the MODE SELECT command.

Byte 02, Bit 2 – EBD (Even Byte Disconnect)

Enables disconnects on even (4-byte) boundaries. This bit is ignored by the tape drive because the tape drive always disconnects on 4-byte boundaries between data phases. The value returned is 1. (For EXB-8500 compatibility, this bit can be set to 0 or 1.)

Note: Even-byte disconnect applies only when more data is to be transferred for the current command. If no more data is to be transferred, a disconnect may occur on an odd-byte boundary.

Byte 02, Bit 1 – PE (Parity Enable)

Indicates whether parity checking on the SCSI bus is enabled, as follows:

0 – Parity checking disabled.
1 – Parity checking enabled. (Power-on default)

When this bit is 1, every byte received by the tape drive is checked for parity.

Byte 02, Bit 0 – NAL (No Auto Load)

Indicates whether the automatic loading of the tape into the tape path is disabled when a data cartridge is inserted into the tape drive, as follows:

0 – Auto loading enabled. (Power-on default)
1 – Auto loading disabled.

Byte 03, Bits 7 through 5 – RTF (Read Tape Format)

Indicates the format of the data on the currently loaded data cartridge, as follows:

000b – 8500 format
001b – 8200 format
010b – 8500c format
100b – Mammoth format

Note: If the tape is blank or written in an unrecognized format, or if the tape drive is not ready, the tape drive returns the format in which it would write if the tape were positioned at LBOT (Mammoth format).

This field is ignored by the tape drive in the MODE SELECT command.

Byte 03, Bits 4 through 2 – WTF (Write Tape Format)

Indicates the format the tape drive uses to write data to tape, as follows:

100b – Mammoth format

This field is ignored by the tape drive in the MODE SELECT command.

Byte 03, Bit 0 – 112m

This bit is ignored by the tape drive. (For EXB-8500 compatibility, this bit can be set to 0 or 1.)

Byte 04 – Motion Threshold

Indicates the amount of data that must be in the buffer before tape motion is started for a buffered write or read operation. The value represents a percentage of the buffer. Each 1h equals 0.39% of the buffer. 80h is the power-on default value, representing one half of the buffer. By default, the tape drive automatically adjusts this value (auto-thresholding) based on the transfer rate of the host. See for more information about auto-thresholding and the Motion Threshold.

Notes:

- The default value for this field depends on whether auto-thresholding is enabled.

- The Motion Threshold has the same function as the Write Buffer Full Ratio and the Read Buffer Empty Ratio in the Device Configuration Page. If both the Vendor Unique Parameters Page 1 and the Device Configuration Page are sent, the value that is received last by the tape drive takes precedence.

Byte 05 – Gap Threshold

This field has the same function as the Gap Threshold in the Vendor Unique Parameters for non-page format and in the Device Configuration Page for page format. See page 9-19 for a description of this field. The value received last by the tape drive takes precedence. Valid values for the Gap Threshold byte are 00h to FFh. The default value is 00h. Any value greater than 07h is treated as 07h.

9.16 Vendor Unique Parameters Page 2 (Page Code= 21h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Page Length							
02	Reserved							
03	RSVD	LPART						WWR
04	Reserved							
05								

Byte 00, Bits 5 through 0 – Page Code

Identifies the page being transferred. The valid value is 21h (Vendor Unique Parameters Page 2).

Byte 01 – Page Length

Indicates the number of bytes in the Vendor Unique Parameters Page 2 that follow this byte. The valid value is 04h.

Byte 03, Bits 6 through 1 – LPART (Load Partition)

Indicates which partition the tape drive will position the tape to the next time it loads a tape or after it formats partitions on the current tape, as follows:

n – Position to the beginning of partition *n*, where *n* is a value from 0 to 63. Partitions are numbered sequentially from the end of the tape with partition 0 always being the last partition on the tape.

Note: If the requested partition does not exist on the tape, the tape drive will load to the highest numbered partition on the tape (the partition closest to LBOT).

The power-on default for LPART is 0.

Byte 03, Bit 0 – WWR (Write without Retries)

Indicates whether the tape was written with retries. (This bit is ignored by the tape drive in the MODE SELECT command.)

0 – The tape was written with retries.
1 – The tape was written with no retries.

Note: The tape drive writes a tape without retries when you issue a MODE SELECT command at LBOT and set the Write Retry Count field (Read-Write Error Recovery Page) to 00h. If the tape was written without retries, it should be read without retries. For this reason, if the WWR bit is 1, issue a MODE SELECT command to set the Read Retry Count field (Read-Write Error Recovery Page) to 00h.

9.17 Exceptions and Error Conditions

The following exceptions and error conditions can occur with the MODE SELECT command.

Illegal Value in MODE SELECT Data

If one of the bytes sent with the MODE SELECT data contains an illegal value or if a reserved bit is set, the tape drive returns Check Condition status. To determine where the error is, issue a REQUEST SENSE command. The sense key will be set to Illegal Request (5h) and the sense key specific data (bytes 15 through 17 of the sense data) will indicate the exact location of the error.

Notes

10 PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	1	0
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								Prevent
05	Vendor Unique		Reserved				0	0

10.1   About This Command

You can use the PREVENT/ALLOW MEDIUM REMOVAL command to allow or disallow the removal of the data cartridge from the tape drive.

The PREVENT/ALLOW MEDIUM REMOVAL command is reservation independent. The tape drive will execute a PREVENT/ALLOW MEDIUM REMOVAL command issued by any initiator even if the tape drive is reserved by another initiator.

If an initiator has issued a PREVENT MEDIUM REMOVAL (1Eh) command to prevent the removal of the data cartridge, the data cartridge will not be ejected until that initiator sends an ALLOW MEDIUM REMOVAL command to allow the data cartridge to be removed.

If more than one initiator has issued PREVENT MEDIUM REMOVAL commands to the tape drive to prevent the removal of the data cartridge, the cartridge will not be ejected until each of those initiators sends an ALLOW MEDIUM REMOVAL command to release the condition.

Effect on the Unload Button

When removal of the data cartridge is prevented by the PREVENT/ALLOW MEDIUM REMOVAL command, the tape drive's unload button is disabled; pressing this button does not cause the tape to be rewound or ejected.

Effect on the UNLOAD (1Bh) Command

When removal of the data cartridge is prevented by the PREVENT/ALLOW MEDIUM REMOVAL command, issuing an UNLOAD (1Bh) command causes the tape to be unloaded from the tape path but not ejected from the tape drive. Any data in the buffer is written to tape before the tape is rewound and unloaded from the tape path.

10.2   Field Definitions

Byte 04, Bit 0 – Prevent

Prevents or allows the removal of the data cartridge from the tape drive, as follows:

0 – Allow the data cartridge to be removed
1 – Prevent the data cartridge from being removed

The prevent-data-cartridge-removal condition terminates when any of the following conditions occur:

- A PREVENT/ALLOW MEDIUM REMOVAL command with the Prevent bit set to 0 is received from all initiators that set the prevent condition

- The tape drive is reset by a Bus Device Reset message, SCSI bus reset, or power-on reset

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value of this field must be 0.

11   READ (08h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	1	0	0	0
01	Logical Unit Number			Reserved			SILI	Fixed
02	(MSB)							
03				Transfer Length				
04								(LSB)
05	Vendor Unique			Reserved			0	0

11.1   About This Command

The READ command transfers one or more bytes or blocks of data from the tape drive to the initiator, beginning with the next logical block. The tape drive reads tapes written in Mammoth, 8500c, 8500, and 8200 formats, and automatically determines the format of the data on the tape.

➤ **Important**   The tape drive cannot read tapes written in 8200c format. If you attempt to read an 8200c format tape, the tape drive returns Check Condition status with a sense key of Medium Error (3h) and an FSC of 1Ch.

Notes:

- The tape drive can read tapes that have a combination of fixed-length and variable-length data blocks.

- The tape drive will report the early-warning condition (LEOP reached) if the REW bit is set with the MODE SELECT command (byte 8, bit 0 in the Device Configuration Page).

11.2   Field Definitions

Byte 01, Bit 1 – SILI (Suppress Illegal Length Indication)

The SILI bit is used to suppress an illegal length Check Condition status for read operations that read logical blocks that do not contain the defined number of bytes. This bit is valid only when the read operation is for variable-length logical blocks (that is, when the Fixed bit is set to 0).

0 – Do not suppress illegal length indication Check Condition status.
1 – Suppress illegal length indication Check Condition status.

Notes:

- If the Fixed bit is 1 (fixed-length logical blocks) and the SILI bit is 1, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The ASC and ASCQ fields are set to 24h and 00h.

- If the Fixed bit is 0 and the SILI bit is 1, Check Condition status is suppressed for all cases in which the length of the logical block to be read is less than the length specified by the Transfer Length field. If the length of the logical block is greater than the length specified by the Transfer Length field, Check Condition status is suppressed only if the Block Length field of the MODE SELECT Block Descriptor is 0.

- The tape drive never transfers more data than requested, regardless of the setting of the SILI bit.

Byte 01, Bit 0 – Fixed

The Fixed bit defines the type of read operation to be performed, as follows:

0 – Read a single logical block. The length of this block is specified in the Transfer Length field.

1 – Read one or more fixed-length logical blocks. The number of blocks is specified in the Transfer Length field. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT parameters (bytes 5 through 7 of the Block Descriptor).

Note: The tape drive returns Check Condition status with the sense key set to Illegal Request (5h) if the Fixed field in the READ command is 1 (fixed-length logical blocks) and the Block Length field in the current MODE SELECT data is 0 (variable-length logical block). The ASC and ASCQ bits are set to 81h and 00h (fixed/variable mismatch).

Bytes 02 through 04 – Transfer Length

The Transfer Length field specifies the amount of data to be read, as follows:

- When the Fixed bit is set to 0, the Transfer Length field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 240 KB. (1 KB = 1,024 bytes.)

- When the Fixed bit is set to 1, the Transfer Length field contains the number of logical blocks to be read. The block length is the length specified with the MODE SELECT command. The allowable block sizes are defined by the READ BLOCK LIMITS (05h) command.

The data is read from the next logical block on the tape and is transferred to the initiator.

Note: When the value for the Transfer Length field is 0, no data is transferred and the current position of the tape is not changed. A value of 0 for these bytes is not an error.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0.

11.3 Exceptions and Error Conditions

The following exceptions and error conditions can occur with the READ command.

Filemark Detected

If the tape drive detects a filemark before completing the read operation, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Depend on the setting of the Fixed bit, as follows: ■ If the Fixed bit is 0, equal the requested transfer length. ■ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks read.
ASC	00h
ASCQ	01h
FSC	0Dh

When the READ command terminates, the logical position is at the EOT side of the filemark encountered.

Setmark Detected

Note: This error applies to tapes written in 8500c format only.

If the RSmk bit in the MODE SELECT Device Configuration page (Page Code= 10h) is set to 1 and the tape drive detects a setmark before completing the read operation, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested transfer length. ▪ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks read.
ASC	00h
ASCQ	03h
FSC	1Dh

When the READ command terminates, the logical position is at the EOT side of the setmark encountered.

EOD Detected

If the tape drive detects the EOD mark (or blank tape for 8200 format) during the read operation, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Blank Check (8h)
Information bytes	Depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested transfer length. ▪ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks read.
ASC	00h
ASCQ	05h
FSC	0Ch

When the READ command terminates, the logical position is after the last recorded data block, filemark, or setmark.

PEOT or PEOP Encountered

During a read operation, if the tape drive encounters the physical end of tape (PEOT) or the physical end of partition (PEOP), it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Medium Error (3h)
Information bytes	If Valid= 1, depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested transfer length. ▪ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks read.
ASC	3Bh
ASCQ	02h
PEOT	1
FSC	14h

When the READ command terminates, the logical position is undefined.

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the read operation, the tape drive terminates the READ command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid= 1, depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested transfer length. ▪ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks read. The actual number does not include the unrecovered block.
Other bits and bytes	Depend on the error condition

When the READ command is terminated, the tape drive is positioned after the unrecovered block for a Medium Error or in an undefined position for a Hardware Error.

Note: In both fixed and variable block modes, the tape drive may have entered the Data Phase before reporting this error.

Transfer Length Incorrect

If the actual transfer length does not match the requested transfer length, the information reported depends on the setting of the Fixed bit.

Variable Length Mode (Fixed = 0)

If the Fixed bit is 0 and the actual length of the block on the tape does not match the transfer length requested, the tape drive transfers the number of bytes available up to the transfer length requested. Then, it terminates the READ command and returns Check Condition status. (The Check Condition status may be suppressed if the SILI bit is set to 1.)

The REQUEST SENSE data is set as follows:

Valid	1
ILI	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the actual length and the requested length: ■ If the requested length is greater than the actual length, the Information bytes are positive. ■ If the requested length is less than the actual length, the Information bytes are negative (2s complement notation).
ASC	00h
ASCQ	00h
FSC	0Ah

When the READ command terminates in variable mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block).

Fixed Length Mode (Fixed = 1)

If the Fixed bit is 1 and the actual length of any one block does not match the requested block length, the tape drive transfers the number of blocks requested until it encounters the block with the incorrect length. Then, it terminates the READ command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
ILI	1
Sense Key	No Sense (0h)
Information bytes	Indicate the number of blocks not transferred to the initiator, including the block with the incorrect length.
ASC	00h
ASCQ	00h
FSC	0Ah

When the READ command terminates in fixed mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block).

Illegal Requests

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

- The Fixed bit is set to 1 and the block length in the MODE SELECT command is 0.

- The Fixed bit is set to 1 and the SILI bit is set to 1.

- The Fixed bit is set to 0 and the requested block length is greater than 240 KB.

- The tape is in an invalid position for the tape drive to perform a read operation (a READ command was issued after a WRITE or WRITE FILEMARKS command).

- The tape drive is not ready or no data cartridge is loaded.

Compression Errors

The tape drive can report two types of compression errors during a read operation:

- If the compression circuit is unable to decompress previously compressed data during a read operation, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Sense Key	Hardware Error (4h)
ASC	11h
ASCQ	00h
FSC	18h

- If the read decompression CRC fails during a read operation, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Sense Key	Hardware Error (4h)
ASC	11h
ASCQ	02h
FSC	19h

To recover from either of these errors, follow these steps:

1. Reissue the failed command or command sequence.

2. Power the tape drive off and back on again.

   or

   Send a SCSI bus reset ("hard" reset).

If the error persists, the tape may be bad or the tape drive may require service.

Notes

12 READ BLOCK LIMITS (05h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	0	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	Vendor Unique		Reserved				0	0

12.1 About This Command

The READ BLOCK LIMITS command requests that the tape drive return data identifying the maximum and minimum logical block lengths supported. The data returned by the READ BLOCK LIMITS command applies to both the variable and fixed block lengths for the READ and WRITE commands.

12.2 Field Definitions

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for this command. The value of this field must be 0.

12.3 Read Block Limits Data

The tape drive returns Read Block Limits data to the initiator to indicate the maximum and minimum block lengths it supports.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01	(MSB)							
02				Maximum Block Length				
03								(LSB)
04	(MSB)							
05				Minimum Block Length				(LSB)

Bytes 01 through 03 – Maximum Block Length

The tape drive returns 3C000h (240 KB) for the Maximum Block Length.

Note: 1 KB = 1,024 bytes.

Bytes 04 and 05 – Minimum Block Length

The tape drive returns 0001h (1 byte) for the Minimum Block Length.

13 READ BUFFER (3Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	1	0	0
01	Logical Unit Number			Reserved		Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Allocation Length							
08								(LSB)
09	Vendor Unique		Reserved				0	0

13.1 About This Command

The READ BUFFER command is used to create a diagnostic listing of tape drive data for later analysis. You can obtain data about the tape drive's state or actual read or write data from the tape drive's buffer.

13.2   Field Definitions

Byte 01, Bits 2 through 0 – Mode

The Mode field specifies the type of data to be returned to the initiator:

010b – Buffer data.
011b – Buffer descriptor information (described on).

Byte 02 – Buffer ID

The Buffer ID field specifies the buffer for which the initiator is requesting data:

00h – Read and write data buffer (image of tape data).
01h – Diagnostic data buffer.

Note: All other buffer ID values are reserved for use by Exabyte.

If you set the Mode field to 010b and the Buffer ID field to 01h, diagnostic information is returned. This data can be used by Exabyte to diagnose tape drive problems.

Bytes 03 through 05 – Buffer Offset

The Buffer Offset field indicates the byte offset within the buffer specified by the Buffer ID. The value must be less than the Buffer Capacity minus the total number of bytes to be transferred, and must be a multiple of:

$$2^{Offset\ Boundary}$$

The Buffer Capacity and Offset Boundary values are returned in the Buffer Descriptor (see).

Bytes 06 through 08 – Allocation Length

The Allocation Length field specifies the amount of space, in bytes, that the initiator has allocated for buffer data returned from the tape drive. The amount of data returned is the Allocation Length or the total amount of data in the buffer, whichever is less.

Note: If you are requesting buffer descriptor information
          (Mode = 011), set the Allocation Length to at least 4 bytes.

Byte 09, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value of this field must be 0.

Buffer Descriptor

If you set the Mode field to 011b, the tape drive returns a Buffer Descriptor for the buffer specified by the Buffer ID field.

Bit Byte	7	6	5	4	3	2	1	0
00	Offset Boundary							
01	(MSB)							
02	Buffer Capacity							
03								(LSB)

Byte 00 – Offset Boundary

Indicates the boundary alignment within the selected buffer.

Table 13-1 describes the values for the Offset Boundary field. For subsequent WRITE BUFFER or READ BUFFER commands, use this value as a power of two in the Buffer Offset field.

Table 13-1   Offset Boundary values

Offset Boundary value	Buffer offset	$2^{Offset\ Boundary}$ (use for Buffer Offset)
00h	Byte boundaries	$2^0 = 1$
01h	Even-byte boundaries	$2^1 = 2$
02h	Four-byte boundaries	$2^2 = 4$
03h	Eight-byte boundaries	$2^3 = 8$
04h	16-byte boundaries	$2^4 = 16$
$\vdots$	$\vdots$	$\vdots$
FFh	0 is the only supported buffer offset	not applicable

Bytes 01 through 03 – Buffer Capacity

Indicates the size of the buffer in bytes. Currently, the size of buffer 00 (read and write data buffer) is approximately 4 MB. The size of buffer 01 (diagnostic data buffer) is approximately 1 MB. These values may change with new releases of tape drive microcode.

13.3　Exceptions and Error Conditions

The following exceptions and error conditions can occur with the READ BUFFER command.

Illegal Requests

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

- An unsupported Buffer ID is specified in the CDB.
- An invalid Buffer Offset is specified in the CDB.

14 READ POSITION (34h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	0	1	0	0
01	Logical Unit Number			Reserved				BT
02 ⋮ **08**	Reserved							
09	Vendor Unique		Reserved				0	0

14.1 About This Command

The READ POSITION command reports the tape drive's current logical position but does not cause tape motion to occur. As described in Chapter 6, the READ POSITION command is used with the LOCATE (2Bh) command to position the tape at a specified logical block address.

Notes:

- The READ POSITION command is not supported for tapes written in 8200 format and will result in Check Condition status with the sense key set to Illegal Request (5h).

- If you issue a READ POSITION command when no data cartridge is loaded, the tape drive returns Check Condition status with the sense key set to Not Ready (2h). The ASC and ASCQ fields are set to 3Ah and 00h.

14.2   Field Definitions

Byte 01, Bit 0 – BT (Block Type)

This bit determines the type of block number to be returned to the initiator, as follows:

0 – Return the SCSI logical block ID, numbered sequentially from the beginning of the tape or from the beginning of each partition. The number includes setmarks and filemarks.

1 – Return the logical block number, not including setmarks or filemarks. (This setting is not recommended for normal use.)

Byte 09, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value of this field must be 0.

14.3   Read Position Data

When it completes the READ POSITION command, the tape drive returns 20 bytes of Read Position data to the initiator.

Bit Byte	7	6	5	4	3	2	1	0
00	BOP	EOP	Reserved			BPU	Reserved	
01	Partition Number							
02	Reserved							
03								
04	(MSB)							
⋮	First Block Location							
07								(LSB)
08	(MSB)							
⋮	Last Block Location							
11								(LSB)
12	Reserved							
13	(MSB)							
⋮	Number of Blocks in Buffer							
15								(LSB)
16	(MSB)							
⋮	Number of Bytes in Buffer							
19								(LSB)

Byte 00, Bit 7 – BOP (Beginning of Partition)

Indicates whether the tape is positioned at the beginning of a partition, as follows:

0 – The tape is not positioned at the beginning of a partition.

1 – For a partitioned tape, the tape is positioned at the logical beginning of the currently active partition (LBOP). For a non-partitioned tape, the tape is positioned at LBOT.

Byte 00, Bit 6 – EOP (End of Partition)

Indicates whether the tape is positioned at the end of a partition, as follows:

0 – The tape is not positioned at the end of a partition.

1 – For a partitioned tape, the tape is positioned between the logical end of partition (LEOP) and the physical end of partition (PEOP) of the currently active partition. For a non-partition tape, the tape is positioned between LEOT and PEOT.

Byte 00, Bit 2 – BPU (Block Position Unknown)

Indicates whether the block position is known, as follows:

0 – The block position is known and the remainder of the READ POSITION data is valid.

1 – The block position is not known and cannot be obtained without tape motion. The remainder of the READ POSITION data is not valid.

Byte 01 – Partition Number

Indicates the number of the partition in which the tape is currently located, as follows:

n – The current location is in partition *n*, where *n* is a value from 0 through 63. Note that partitions are numbered consecutively from the *end* of the tape. Partition 0 is always the last partition on the tape.

Note: If the tape is not partitioned, a value of 0 is returned.

Bytes 04 through 07 – First Block Location

Indicates the block address associated with the current logical block position (that is, the block address of the next data block to be transferred between the initiator and the tape drive if a READ or WRITE command is issued). When using a LOCATE command to search for this position, specify the value returned for this field as the Block Address in byte 03 through 06 of the LOCATE CDB.

Note: If a READ POSITION command follows an immediate command, the returned position will be the expected position after the immediate command is completed.

Bytes 08 through 11 – Last Block Location

The Last Block Location field is not supported by the tape drive. The value returned for this field is 0.

Bytes 13 through 15 – Number of Blocks in Buffer

The Number of Blocks in Buffer field is not supported by the tape drive. The value returned for this field is 0.

Bytes 16 through 19 – Number of Bytes in Buffer

The Number of Bytes in Buffer field is not supported by the tape drive. The value returned for this field is 0.

Notes

15 RECEIVE DIAGNOSTIC RESULTS (1Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03	(MSB)			Allocation Length				
04								(LSB)
05	Vendor Unique		Reserved				0	0

15.1 About This Command

You can use the RECEIVE DIAGNOSTIC RESULTS command to obtain the results of tests requested by a previous SEND DIAGNOSTIC (1Dh) command. See Chapter 20 for descriptions of these tests.

Note: To ensure that the diagnostic results are up-to-date and accurate, be sure that the RECEIVE DIAGNOSTIC RESULTS command immediately follows the SEND DIAGNOSTIC command and that the tape drive is reserved for the initiator's exclusive use.

15.2 Field Definitions

Bytes 03 and 04 – Allocation Length

Specifies the number of bytes that the initiator has allocated for the return of RECEIVE DIAGNOSTICS RESULTS data.

To receive all available diagnostic information, specify a value for the Allocation Length field that equals the Page Length for the diagnostic page requested plus 4 bytes. A value of 0 for the Allocation Length field indicates that no diagnostic data will be returned and is not an error.

The tape drive terminates the Data In phase when the number of bytes specified in the Allocation Length field has been transferred or when all available data has been transferred to the initiator, whichever is less.

Byte 05, Bits 6 and 7 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0.

15.3 Returning SEND DIAGNOSTIC Data

The tape drive returns a diagnostic page that reports the results of the previous SEND DIAGNOSTIC command.

Block Diagram for the Diagnostic Page

Bit Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB)							
03	Page Length							(LSB)
04	Diagnostic Parameter							

Byte 00 – Page Code

The Page Code field identifies which of two diagnostic pages is being returned. The tape drive returns the following Page Codes, as follows:

- 90h if UntOfL (byte 1, bit 0) of the preceding SEND DIAGNOSTIC command is 0.

- 91h if UntOfL (byte 1, bit 0) of the preceding SEND DIAGNOSTIC command is 1.

Bytes 02 and 03 – Page Length

Indicates the number of Diagnostic Parameter bytes that follow this field. The tape drive returns a Page Length of 0001h (1 byte).

Byte 04 – Diagnostic Parameter

Indicates the result of the diagnostic test:

00h – The tape drive passed the test.
01h to FFh – The tape drive failed the test.

Note: If the tape drive failed the test, the value returned corresponds to a Fault Symptom Code. These codes are described in Appendix B.

Notes

16 RELEASE UNIT (17h, 57h)

6-Byte RELEASE UNIT (17h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Logical Unit Number			3rdPty	Third Party Device ID			RSVD
02	Reserved							
03								
04								
05	Vendor Unique		Reserved				0	0

10-Byte RELEASE UNIT (57h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	1	0	1	1	1
01	Logical Unit Number			3rdPty	Reserved		0	RSVD
02	Reserved							
03	Third Party Device ID							
04 ⋮ 08	Reserved							
09	Vendor Unique		Reserved				0	0

16.1   About This Command

The RELEASE UNIT command releases a tape drive from an initiator's exclusive use or, if third-party reservations are in effect, from another SCSI device's use. To have effect, the command must be issued by the initiator that reserved the tape drive with a RESERVE UNIT command.

It is not an error to attempt to release a tape drive that is not currently reserved by the current initiator, but if the tape drive is reserved by another initiator, then that reservation remains in effect.

The RELEASE UNIT command is available as a 6-byte CDB and as a 10-byte CDB. You can use either version of the command.

16.2   Field Definitions

Byte 01, Bit 4 – 3rdPty

Indicates whether to releases a third-party reservation, as follows:

0 – Do not release the third-party reservation.
1 – Release the third-party reservation.

Byte 01, Bits 3 through 1 (6-byte CDB)
or Byte 03 (10-byte CDB) – Third Party Device ID

Indicates the SCSI ID of the device for which the tape drive is reserved. The tape drive ignores this field if the initiator is not requesting a third-party reservation release.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0.

17 REQUEST SENSE (03h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	1	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04	Allocation Length							
05	CLRCNT	VU	Reserved				0	0

17.1   About This Command

The REQUEST SENSE command requests that the tape drive transfer sense data to the initiator.

The sense data is valid for the Check Condition status just presented to the initiator. This sense data is preserved in the tape drive for the initiator receiving the Check Condition status. Sense data is cleared when any subsequent command other than INQUIRY (12h) is received from the initiator receiving the Check Condition status.

17.2   Field Definitions

Byte 04 – Allocation Length

Specifies the number of bytes that the initiator has allocated for returned sense data. The tape drive provides a total of 32 (20h) bytes of sense data.

Byte 05, Bit 7 – CLRCNT

Indicates whether to reset the Tracking Retry counter, the Read/Write Retry counter, and the Underrun/Overrun counter, as follows:

0 – Do not reset counters.
1 – Reset counters.

If the CLRCNT bit is set to 1, the counters are reset when the REQUEST SENSE command completes. The initiator must allocate at least 29 (1Dh) bytes for sense data to be read in order to reset the counters.

Note: Values for the Tracking Retry, Read/Write Retry, and Underrun/Overrun counters are returned in the REQUEST SENSE sense data.

Byte 05, Bit 6 – VU (Vendor Unique)

There is no vendor unique definition for this bit. The value for this bit must be 0.

17.3   Extended Sense Bytes

Bit Byte	7	6	5	4	3	2	1	0
00	Valid	Error Code						
01	Segment Number							
02	FMK	EOM	ILI	RSVD	Sense Key			
03 ⋮ 06	(MSB) Information (LSB)							
07	Additional Sense Length							
08	Log Parameter Page Code							
09	Log Parameter Code							
10	Reserved							
11	Underrun/Overrun Counter							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Reserved							
15	SKSV							
16	Sense Key Specific Data							
17								
18	Reserved							
19	PF	BPE	FPE	ME	ECO	TME	TNP	LBOT
20	RSVD	TMD	WP	FMKE	URE	WEI	SSE	FE
21	RSVD	UCLN	RRR	CLND	CLN	PEOT	WSEB	WSEO
22	Reserved							
23	(MSB)							
24	Remaining Tape							
25	(LSB)							
26	Tracking Retry Counter							
27	Read/Write Retry Counter							
28	Fault Symptom Code							
29 – 31	Reserved							

Field Definitions for the Extended Sense Bytes

Byte 00, Bit 7 – Valid

0 – The data in the Information bytes is undefined.

1 – The data in the Information bytes (bytes 03 through 06) is valid for the command receiving the Check Condition status.

Byte 00, Bits 6 through 0 – Error Code

70h – The sense data is associated with the command that received the Check Condition status.

71h – The sense data is for a deferred error condition and is associated with an earlier command.

Byte 01 – Segment Number

This byte is always 0.

Byte 02, Bit 7 – FMK (Filemark)

1 – The current command detected a filemark.

Byte 02, Bit 6 – EOM (End of Medium)

When set to 1, this bit indicates either of the following conditions:

- The tape is at LBOP (logical beginning of partition).
- The tape is at or past the early warning (logical end of tape).

Byte 02, Bit 5 – ILI (Illegal Length Indicator)

1 – The logical block length requested did not match the actual logical block length of the data recorded on the tape.

Byte 02, Bit 3 through 0 – Sense Key

The values contained in the Sense Key field are defined in Table 17-1.

Table 17-1 Sense Key values

Sense Key	Meaning	Explanation
0h	No Sense	Indicates that there is no specific sense key information to be reported for the designated logical unit. This occurs when a command completes successfully or returns Check Condition status with the FMK, EOM, or ILI bits set to 1.
1h	Recovered Error	Indicates that the last command completed successfully with some recovery action performed by the tape drive.
2h	Not Ready	Indicates that the tape drive does not contain a data cartridge or that the data cartridge is not loaded. Operator intervention may be required to correct this condition.
3h	Medium Error	Indicates that the command terminated with a non-recoverable error condition that may have been caused by a flaw in the tape.
4h	Hardware Error	Indicates that the tape drive detected a non-recoverable hardware failure while performing the command or during a self-test.
5h	Illegal Request	Indicates that there was an illegal parameter in the CDB or in the additional parameters supplied as data for a command or that the tape drive is in the wrong mode to execute the command.
6h	Unit Attention	Indicates one of the following: ▪ The tape drive has been reset (by a power-on reset, a Bus Device Reset message, or a SCSI bus reset). ▪ An initiator changed the MODE SELECT parameters since the last command was issued to the tape drive. ▪ The unload button was pressed and the data cartridge was ejected. ▪ A data cartridge was inserted and automatically loaded. ▪ The internal microcode (firmware) was changed. ▪ A log parameter (counter) reached a specified threshold value (assuming that RLEC bit on the MODE SELECT Control Mode page is set to 1). This sense key is reported the first time any command is issued by each initiator after the condition is detected, and the requested command is not performed. This sense key is cleared when the next command other than INQUIRY or REQUEST SENSE is received by the tape drive.
7h	Data Protect	Indicates that a command that writes to tape was attempted on a write-protected data cartridge. The write operation is not performed.
8h	Blank Check	Indicates that EOD (blank tape) was encountered during a read, space, or locate operation.

Table 17-1 Sense Key values (*continued*)

Sense Key	Meaning	Explanation
9h	Exabyte	This is a vendor unique sense key used by Exabyte to indicate that a positioning error has occurred. The actual position of the tape drive is undetermined and is not the expected position.
Bh	Aborted Command	Indicates that the tape drive aborted the command. This condition occurs when an Initiator Detected Error (05h) message is received during command execution or when a Message Reject (07h) or SCSI bus parity error is detected by the tape drive during Command or Data Out phase. The initiator may be able to recover by trying the command again.
Dh	Volume Overflow	Indicates that the last WRITE or WRITE FILEMARKS command reached the physical end of tape (PEOT) and that data may remain in the buffer.

Bytes 03 through 06 – Information

Contains a value that represents the number of unprocessed blocks or bytes of data resulting from a Check Condition status for the LOCATE, READ, SPACE, VERIFY, WRITE, or WRITE FILEMARKS commands.

The value in the Information bytes is valid only when the Valid bit (byte 00, bit 7) is set to 1. When the Valid bit is set to 0, any data in these bytes is invalid.

Byte 07 – Additional Sense Length

This byte indicates the Additional Sense Length provided by the tape drive, excluding this byte. The value is 24 (18h).

Byte 08 – Log Parameter Page Code

When a log parameter (write or read error counter) meets the threshold criteria specified with the TMC bit in the LOG SELECT command, the tape drive sets this byte to the Page Code for the parameter. For more information about the LOG SELECT command, refer to Chapter 7.

Byte 09 – Log Parameter Code

When a log parameter (write or read error counter) meets the threshold criteria specified with the TMC bit in the LOG SELECT command, the tape drive sets this byte to the Parameter Code for the parameter. For more information about the LOG SELECT command, refer to Chapter 7.

Byte 11 – Underrun/Overrun Counter

The Underrun/Overrun Counter is a dual-function counter for logging write underruns and read overruns. This counter is used to determine the number of times the initiator failed to maintain the tape drive in streaming mode. It is incremented any time the tape drive repositions the tape after encountering an empty data buffer during a write operation or a full data buffer during a read operation.

The counter is reset to 0 after any of the following:

- A REQUEST SENSE command is issued with the CLRCNT bit (byte 05, bit 7) set to 1 – Note that in order for the reset to be performed, at lease 29 (1Dh) bytes of sense data must be read by the REQUEST SENSE command.

- The tape is loaded or rewound.

- The mode changes from write to read or from read to write.

- The tape drive is reset.

The counter does not roll over from FFFFFFh to 0 but remains at FFFFFFh until reset.

Byte 12 – Additional Sense Code (ASC)

The Additional Sense Code, in conjunction with the Additional Sense Code Qualifier (byte 13), provides additional information about each sense key. Appendix B lists the possible combinations of this byte and the ASCQ byte for each sense key. Only those ASC values used by the tape drive are shown in the appendix.

Byte 13 – Additional Sense Code Qualifier (ASCQ)

The Additional Sense Code Qualifier, in conjunction with the Additional Sense Code (byte 12), provides additional information about each sense key. Appendix B lists the possible combinations of this byte and the ASC byte for each sense key. Only those ASCQ values used by the tape drive are shown in the appendix.

Byte 15, Bit 7 – SKSV (Sense Key Specific Valid)

0 – The Sense Key Specific Data is not valid.
1 – The Sense Key Specific Data is valid.

Bytes 15 through 17 – Sense Key Specific Data

The Sense Key Specific Data is valid only when the sense key is Illegal Request. When the sense key is Illegal Request, the Sense Key Specific Data is defined as follows:

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	Field Pointer							
17								

Byte 15, Bit 6 – C/D (Command/Data)　Indicates the location of the illegal parameter, as follows:

0 – The illegal parameter is in the parameters sent by the initiator.
1 – The illegal parameter is in the command descriptor block.

Byte 15, Bit 3 – BPV (Bit Pointer Valid)　indicates whether the bit pointer for the illegal parameter is valid, as follows:

0 – The Bit Pointer information is not valid.
1 – The Bit Pointer information is valid.

Byte 15, Bits 2 through 0 – Bit Pointer　Specifies which bit of the byte indicated by the Field Pointer is in error. If a multiple bit field is in error, the Bit Pointer indicates the most significant (left-most) bit of the field.

Bytes 16 and 17 – Field Pointer　Specifies which byte of the command descriptor block or parameter data was in error. If a multiple-byte field is in error, the Field Pointer indicates the most significant (left-most) byte of the field.

Bytes 19 through 21 – Unit Sense

For each status bit defined in the Unit Sense bytes, the normal or Good status is 0. When set to 1, these bytes indicate the condition defined for that bit, as follows. Note that the effective value for the RSVD bits is 0.

Byte 19, Bit 7 – PF (Power Fail)　The tape drive has been reset since the last status, or the tape drive has performed an internal reset due to power-up.

Byte 19, Bit 6 – BPE (SCSI Bus Parity Error)   The tape drive detected a SCSI bus parity error.

Byte 19, Bit 5 – FPE (Formatted Buffer Parity Error)   The tape drive detected an internal data buffer parity error.

Byte 19, Bit 4 – ME (Media Error)   In write mode, this bit indicates a permanent write error. In read mode, this bit indicates an uncorrectable read error.

Byte 19, Bit 3 – ECO (Error Counter Overflow)   The Read/Write Retry Counter (byte 27) overflowed to 0.

Byte 19, Bit 2 – TME (Tape Motion Error)   The tape drive detected an error while attempting to acquire tracking.

Byte 19, Bit 1 – TNP (Tape Not Present)   The tape drive does not have a data cartridge inserted.

Byte 19, Bit 0 – LBOT (Logical Beginning of Tape)   The data cartridge is positioned at the logical beginning of tape.

Byte 20, Bit 6 – TMD (Tape Mark Detect Error)   An error occurred when the tape drive was attempting to perform a space filemark operation, resulting in an invalid location relative to the requested location. The Valid bit is set to 1, and the Information bytes (bytes 03 through 06) indicate the difference between the number of filemarks specified by the initiator and the actual number of filemarks processed by the tape drive. This may be a host recoverable error. The initiator needs to re-send the SPACE command with the correct number of filemarks.

Note: This bit is valid for tapes written in 8200 format only.

Byte 20, Bits 5 – WP (Write Protect)   The data cartridge is write protected.

Byte 20, Bit 4 – FMKE (Filemark Error)   A write error occurred when the tape drive was attempting to write a filemark.

Byte 20, Bit 3 – URE (Under Run Error)   A hardware data formatter underrun error occurred. (Byte 20, bit 0, is also set to 1.)

Byte 20, Bit 2 – WE1 (Write Error 1)   The maximum number of rewrites was attempted. Media error.

Byte 20, Bit 1 – SSE (Servo System Error) A catastrophic hardware error occurred. The servo system detected an error.

Byte 20, Bit 0 – FE (Formatter Error) A catastrophic hardware error occurred. The data formatter detected an error.

Byte 21, Bit 6 – UCLN A cleaning cartridge was loaded but the cleaning tape was used up, so a successful cleaning was not performed. This bit is reset to 0 after a successful cleaning is performed or the tape drive is reset.

Byte 21, Bit 5 – RRR (Reverse Retries Required) The tape drive was forced to invoke retries in order to move the tape properly. This bit is reset to 0 when a new tape is loaded.

Byte 21, Bit 4 – CLND The tape drive has been cleaned. This bit is reset to 0 when the next REQUEST SENSE command is received.

Byte 21, Bit 3 – CLN The tape drive needs to be cleaned. This bit is reset to 0 when a successful cleaning cycle is performed. The tape drive's cleaning requirements depend on the number of tape motion hours and the type of tape being used. Whenever you switch from MP to AME cartridges, the tape drive requires cleaning.

Byte 21, Bit 2 – PEOT (Physical End of Tape) The data cartridge is positioned at PEOT.

Byte 21, Bit 1 – WSEB (Write Splice Error) A write splice error occurred. The tape drive encountered blank tape when it was attempting a write splice operation. This is a Hardware Error.

Byte 21, Bit 0 – WSEO (Write Splice Error) A write splice error occurred. The tape drive passed the splice position when it was attempting a write splice operation. This is a Hardware Error.

Bytes 23 through 25 – Remaining Tape

Indicates the amount of tape remaining, in approximately 16-KB physical units. This is the logical end of tape (LEOT) position minus the current physical position. If the position is past LEOT, the value is negative. If there is no data cartridge loaded, the value is 0.

Byte 26 – Tracking Retry Counter

This counter increments when a tracking error occurs during tape motion start-up. It is reset to 0 after any of the following:

- A REQUEST SENSE command is issued with the CLRCNT bit (byte 05, bit 7) set to 1 – Note that in order for the reset to be performed, at lease 29 (1Dh) bytes of sense data must be read by the REQUEST SENSE command.

- The tape is loaded or rewound.

- The mode changes from write to read or from read to write.

- The tape drive is reset.

Byte 27 – Read/Write Retry Counter

This counter increments whenever a read or write operation is unsuccessful and a recovery/retry action is performed. It is reset to 0 after any of the following:

- A REQUEST SENSE command is issued with the CLRCNT bit (byte 05, bit 7) set to 1 – Note that in order for the reset to be performed, at least 29 (1Dh) bytes of sense data must be read by the REQUEST SENSE command.

- The tape is loaded or rewound.

- The mode changes from write to read or from read to write.

- The tape drive is reset.

Byte 28 – Fault Symptom Code

The Fault Symptom Code (FSC) field is an Exabyte-unique byte used to indicate the specific nature of hardware and software errors or other events. Appendix B lists the errors indicated by the Fault Symptom Code byte.

Sense Byte Pending Status

When the tape drive reports Check Condition status in response to a command from an initiator, the tape drive retains the sense byte pending status, including error information and Check Condition status, for the initiator until one of the following occurs:

- Error information is reset by the next command other than INQUIRY from the same initiator.

- Error information is reset by a power-on reset, a Bus Device Reset message, or a SCSI bus reset condition.

18 RESERVE UNIT (16h, 56h)

6-Byte RESERVE UNIT (16h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Logical Unit No			3rdPty	Third Party Device ID			RSVD
02	Reserved							
03								
04								
05	Vendor Unique		Reserved				0	0

10-Byte RESERVE UNIT (56h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	1	0	1	1	0
01	Logical Unit No			3rdPty	Reserved		0	RSVD
02	Reserved							
03	Third Party Device ID							
04 ⋮ 08	Reserved							
09	Vendor Unique		Reserved				0	0

18.1 About This Command

The RESERVE UNIT command reserves the tape drive for an initiator's exclusive use or, if third-party reservations are in effect, for another SCSI device's use. The reservation remains in effect until a RELEASE UNIT command is received from the same initiator or until the tape drive is reset by a SCSI bus reset, a Bus Device Reset message, or a power-on reset.

It is not an error for the initiator that made the last reservation to send another valid RESERVE UNIT command.

If the tape drive is reserved and any command (other than an INQUIRY (12h), PREVENT/ALLOW MEDIUM REMOVAL (1Eh), or REQUEST SENSE (03h) command) is received from another initiator, the command will not be honored. Reservation Conflict (18h) status is returned to the initiator that sent the command.

The RESERVE UNIT command is available as a 6-byte CDB and as a 10-byte CDB. You can use either version of the command.

18.2 Field Definitions

Byte 01, Bit 4 – 3rdPty

Indicates whether a third-party reservations is requested, as follows:

0 – A third-party reservation is not requested.
1 – A third-party reservation is requested.

Byte 01, Bits 3 through 1 (6-byte CDB) or Byte 03 (10-byte CDB) – Third Party Device ID

Indicates the SCSI ID of the device for which the initiator is making the third-party reservation. The tape drive ignores this field if the initiator is not requesting a third-party reservation.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0.

19 REWIND (01h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Logical Unit Number			Reserved				Immed
02	Reserved							
03								
04								
05	Vendor Unique		Reserved				0	0

19.1 About This Command

The REWIND command causes the tape drive to rewind the tape to the logical beginning of tape (LBOT) or, if the tape is partitioned, to the logical beginning of the partition (LBOP) in which the tape is currently positioned.

Notes:

- If the disconnect option is enabled, the tape drive disconnects from the initiator while the REWIND command is executing.

- If the tape is already at LBOT (or LBOP for a partitioned tape) and there is no data in the buffer, no tape motion results.

- If a command is received by the tape drive while the tape is rewinding, the tape drive executes the command after it reaches LBOT or LBOP.

- If the REWIND command is received after a WRITE (0Ah) or WRITE FILEMARKS (10h) command, buffered data, filemarks, or setmarks and an end of data (EOD) mark are written to the tape before it is rewound.

- If an error occurs during the writing of the data in the buffer to the tape, the tape drive returns Check Condition status. The rewind operation is not performed. The initiator should issue a REQUEST SENSE (03h) command to determine the cause of the error.

- If there is data in the buffer because an earlier WRITE (0Ah) command was terminated with Check Condition status, that data is discarded before the tape is rewound.

19.2   Field Definitions

Byte 01, Bit 0 – Immed

Determines when command status is returned to the initiator, as follows:

0 – Status is reported when the REWIND command is completed.

1 – Status is reported when the REWIND command is initiated by the tape drive.

If the tape drive's buffer contains data from a previous WRITE command, the tape drive disconnects from the initiator (if disconnect is enabled) and writes the data in the buffer to the tape.

- **If the Immed bit is set to 1**, the tape drive reconnects to the initiator when the write operation has completed successfully. It then returns Good status and performs the rewind operation.

  Note: Completing the write operation includes emptying the buffer to tape and writing the EOD mark.

- **If the Immed bit is set to 0**, the tape drive reconnects and returns status when the rewind operation is complete.

Byte 05, Bit 7 and 6 – Vendor Unique

There are no vendor unique definitions for these bits. The value for this field must be 0.

20 SEND DIAGNOSTIC (1Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	1
01	Logical Unit Number			PF	RSVD	SelfTest	DevOfL	UntOfL
02	Reserved							
03	(MSB)							
04	Parameter List Length							(LSB)
05	Vendor Unique		Reserved				0	0

20.1 About This Command

The SEND DIAGNOSTIC command causes the tape drive to perform certain diagnostic tests. If a test is successful, the tape drive returns Good status; otherwise, it returns Check Condition status. When this command is followed by a RECEIVE DIAGNOSTIC RESULTS (1Ch) command or a REQUEST SENSE (03h) command, detailed results of these diagnostic tests are reported to the initiator.

Notes:

- To ensure that the diagnostic data returned is valid, the SEND DIAGNOSTIC command must be immediately followed by the RECEIVE DIAGNOSTIC RESULTS command.

- To ensure that the results of the diagnostic test are not destroyed by a command sent by another initiator, the tape drive should be reserved for the initiator's exclusive use.

- The initiator must support the disconnect option if you plan to use the SEND DIAGNOSTIC command because the tape drive will disconnect from the initiator while the command is executing.

- If the requested test involves a tape, either of the following conditions causes the SEND DIAGNOSTIC command to return Check Condition status with the sense key set to Illegal Request (5h) and the ASC and ASCQ fields set to 53h and 02h.

  - The Prevent bit in the PREVENT/ALLOW MEDIUM REMOVAL (1Eh) command is set to 1 (prevent media removal).

  - The NAL bit in MODE SELECT (15h) is set to 0 (autoloading disabled).

20.2   Field Definitions

Byte 01, Bit 4 – PF (Page Format)

The Page Format bit specifies the format of the parameter list for the SEND DIAGNOSTIC command. The tape drive does not support page format, so the valid value for this bit is 0.

Byte 01, Bit 2 – SelfTest

Must be 1. The tape drive performs its default self-diagnostic test only.

Byte 01, Bit 1 – DevOfL

Specifies whether the tape drive is allowed to perform diagnostic tests that might affect unit reservations, log parameters, or sense data, as follows:

0 – The tape drive may not perform such diagnostic tests.
1 – The tape drive may perform such diagnostic tests.

Byte 01, Bit 0 – UntOfL

Specifies whether the tape drive is allowed to perform diagnostic test that might affect the tape, such as writing data or repositioning the tape, as follows:

0 – The tape drive may not perform diagnostic tests that affect the tape.
1 – The tape drive may perform diagnostic test that affect the tape.

See Table 20-1 for a description of the valid combinations of the SelfTest, DevOfl, and UntOfl bits.

Bytes 03 and 04 – Parameter List Length

Must be 0. Parameter list information is not supported.

Byte 05, Bits 7 and 6 – Vendor Unique

There is no vendor unique definition for this bit. The value for this bit must be 0.

20.3   Diagnostic Tests

Table 20-1 lists the valid combinations of the SelfTest, DevOfL, and UntOfL bits and the resulting actions performed by the tape drive. All other combinations of settings for these fields are undefined and will result in Check Condition status with the sense key set to Illegal Request.

Table 20-1   Valid combinations of SEND DIAGNOSTIC fields

SelfTest	DevOfL	UntOfL	Type of test	Page Code returned for RECEIVE DIAGNOSTIC RESULTS
1	0	0	Code check	90h
		1	Code check	91h
	1	0	Buffer check	90h
		1	Tape operation check	91h

Code Check

The tape drive checks to see if its code image is still valid. This test does not affect tape operations, and no changes to the log parameters are permitted. Any data in the write buffer is written to tape before the test is performed.

Buffer Check

The tape drive checks its main data buffer for proper operation. This test does not affect tape operations. Various parameters, such as mode parameters, may be altered.

Tape Operation Check

The tape drive first performs the buffer check described above. Then, if an Exabyte AME tape is loaded and the tape is not write protected, the tape drive performs the following steps to test tape operations:

1. Rewinds the tape.

2. Writes approximately 130 MB of data to the tape.

3. Rewinds the tape.

4. Executes a high-speed search to EOD.

5. Rewinds the tape.

6. Repeats steps 2 through 5 one time.

7. Rewinds the tape.

▪ If a tape is not present, the tape drive returns Check Condition status with the sense key set to Not Ready (2h). The ASC, ASCQ, and FSC are set to 3Ah, 00h, and C9, respectively.

▪ If the requested test involves a tape, either of the following conditions causes the SEND DIAGNOSTIC command to return Check Condition status with the sense key set to Illegal Request (5h) and the ASC and ASCQ fields set to 53h and 02h.

   ▪ The Prevent bit in the PREVENT/ALLOW MEDIUM REMOVAL (1Eh) command is set to 1 (prevent media removal).

   ▪ The NAL bit in MODE SELECT (15h) is set to 0 (autoloading disabled).

21 SPACE (11h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	0	1
01	Logical Unit Number			Reserved		Code		
02	(MSB)							
03				Count				
04								(LSB)
05	Vendor Unique		Reserved				0	0

21.1 About This Command

The SPACE command enables the tape drive to perform forward or backward high-speed searches. You can use this command to space directly to the end of data (EOD) or to space over a specified number of logical blocks, filemarks, or setmarks.

Notes:

- The tape drive can space over both fixed- and variable-length logical blocks; it determines the type of spacing to use according to the type of block found on the tape.

- If the disconnect option is enabled, the tape drive can disconnect from the initiator while the SPACE command is executing.

▪ If you attempt to space backward immediately after writing data, filemarks, or setmarks, the tape drive will complete the write operation before performing the space operation. Completing the write operation includes writing any buffered data to tape and writing an end of data (EOD) mark.

If an error occurs when the data in the buffer is being written, the tape drive returns Check Condition status and the space operation is not performed. You can issue a REQUEST SENSE (03h) command to determine the cause of the error.

▪ On a partitioned tape, spacing is limited to locations within the current partition. If you want to space to a location outside of the current partition, you must move to the new partition using the LOCATE or MODE SELECT command.

21.2　Field Definitions

Byte 01, Bits 2 through 0 – Code

As shown in Table 21-1, the Code field specifies the type of space operation you want the tape drive to perform.

Table 21-1　Values of Code field for the SPACE (11h) command

Value of Code field	Type of operation	Usage notes
000b	Space over *n* fixed or variable-length blocks	See page 21-4 for information about the errors and exceptions that can occur for these settings.
001b	Space over *n* filemarks	
011b	Space to end of data	If you set the Code field to 011b, the tape drive ignores the setting of the Count field. Instead, it spaces forward until it encounters EOD. The tape is positioned so that a subsequent WRITE command can append data after the last block, filemark, or setmark written before the end of data.

Table 21-1 Values of Code field for the SPACE (11h) command (*continued*)

Value of Code field	Type of operation	Usage notes
100b	Space over *n* setmarks	When you set the Code field to 100b, the tape drive ignores the setting of the RSmk bit on the MODE SELECT Device Configuration page (Page Code= 10h). In addition, filemarks are ignored if you are spacing over setmarks. If you use this Code field setting and the tape is not in a format that supports setmarks, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The Fault Symptom Code is D7h.
010b		If you set the Code field to one of these values, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).
101b	Reserved	
110b		
111b		

Bytes 02 through 04 – Count

Represents the number of blocks, filemarks, or setmarks to be spaced over. The value of *n* determines the direction of spacing, as follows:

- A positive value of *n* in the Count field causes the tape drive to space forward *n* blocks, filemarks, or setmarks. When the space operation is complete, the tape is logically positioned on the EOT side of the *n*th block, filemark, or setmark.

- A negative value of *n* (in 2s complement notation) in the Count field causes the tape drive to space backward over *n* blocks, filemarks, or setmarks. When the operation is complete, the tape is logically positioned on the BOT side of the *n*th block, filemark, or setmark.

- A value of 0 in the Count field causes no change in the tape position and is not an error.

Note: The tape drive ignores the Count field when spacing to end of data.

Byte 05, Bits 7 and 6 – Vendor Unique

There is no vendor unique definition for this bit. The value must be 0.

21.3　Exceptions and Error Conditions

The following exceptions and error conditions can occur with the SPACE command.

Filemark Detected

If the Code field has a value of 000b (space over n logical blocks) and a filemark is detected, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the requested number of blocks and the actual number of blocks spaced over. This value is always positive.
ASC	00h
ASCQ	01h
FSC	32h

If the filemark was detected during a forward search, the tape is logically positioned on the EOT side of the filemark. If the filemark was detected during a backward search, the tape is logically positioned on the BOT side of the filemark.

Note:　Filemarks are ignored if you have set the Code field to space over setmarks (100b).

Setmark Detected

If the Code field has a value of 000b (space over *n* logical blocks) or 001b (space over *n* filemarks) and a setmark is detected, the tape drive looks at the setting of the RSmk bit on the MODE SELECT Device Configuration page (Page Code= 10h):

- If the bit is 0 (do not report setmarks), the tape drive continues to space over blocks or filemarks.

- If the bit is 1 (report setmarks), the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the requested number of blocks or filemarks and the actual number of blocks or filemarks spaced over. This value is always positive.
ASC	00h
ASCQ	03h
FSC	31h

If the setmark was detected during a forward search, the tape is logically positioned on the EOT side of the setmark. If the setmark was detected during a backward search, the tape is logically positioned on the BOT side of the setmark.

EOD Detected

If the Code field has a value of 000b (space over *n* logical blocks), 001b (space over *n* filemarks), or 100b (space over *n* setmarks), and the EOD mark is detected, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Blank Check (8h)
Information bytes	Indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number of blocks, filemarks, or setmarks spaced over. This value is always positive.
ASC	00h
ASCQ	05h
FSC	33h

The tape is positioned so that a subsequent WRITE command can append data after the last information written before EOD.

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered during a space operation (regardless of the value of the Code field), the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Medium Error (3h)
Information bytes	If Valid= 1, indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number of blocks, filemarks, or setmarks spaced over. This value is always positive. **Note:** If the Code field is 011b, the Information bytes are invalid.
ASC	00h
ASCQ	02h
PEOT	1
FSC	34h

PBOT or PBOP Encountered

If the Code field has a value of 000b, 001b, or 100b (space over logical blocks, filemarks, or setmarks) and the physical beginning of tape (PBOT) or physical beginning of partition (PBOP) is encountered, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number of blocks, filemarks, or setmarks spaced over. This value is always positive.
ASC	00h
ASCQ	04h
LBOT	1
FSC	35h

After PBOT (or PBOP) is encountered, the tape is positioned at LBOT (or LBOP).

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the space operation, the tape drive terminates the SPACE command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid= 1, indicate the difference between the requested number of blocks, filemarks, or setmarks and the actual number of blocks, filemarks, or setmarks spaced over. The actual length does not include the unrecovered block. This value is always positive.
Other bits and bytes	Depend on the error condition

When the SPACE command is terminated, the position of the tape drive depends on whether a forward or backward space was attempted:

- If the error occurred during a forward space, the tape drive is positioned after the unrecovered block.

- If the error occurred during a backward space, the tape drive is positioned before the unrecovered block.

Illegal Requests

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

- You attempt a forward space operation immediately after the tape drive has completed a WRITE or WRITE FILEMARKS command.

- You attempt to space over *n* setmarks on a tape written in 8500 or 8200 format. (Spacing over setmarks is permitted only on tapes written in Mammoth format or 8500c format.)

22 TEST UNIT READY (00h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	Vendor Unique			Reserved			0	0

22.1 About This Command

The TEST UNIT READY command provides a means for determining if the tape drive is ready to accept an appropriate medium access command.

The TEST UNIT READY command returns Good status after the tape is loaded if the tape drive is ready to accept a medium access command without returning Check Condition status. If the tape drive is not ready to accept a medium access command, the tape drive returns Check Condition status with the sense key set to Not Ready (2h).

Note: The TEST UNIT READY command is not a request for a unit self-test.

22.2   Field Definitions

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for this command. The value for this field must be 0.

23 VERIFY (13h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	1
01	Logical Unit Number			Reserved		Immed	BytCmp	Fixed
02	(MSB)							
03				Verification Length				
04								(LSB)
05	Vendor Unique		Reserved				0	0

23.1   About This Command

The VERIFY command enables the tape drive to verify one or more logical blocks of data on the tape, beginning with the next logical block. When the VERIFY command is completed, the tape is positioned on the EOT side of the last block of data verified.

23.2   Field Definitions

Byte 01, Bit 2 – Immed

Determines when command status is returned to the initiator, as follows:

0 – Status is returned when the verify operation is complete.

1 – Status is returned when the VERIFY command is initiated by the tape drive.

Byte 01, Bit 1 – BytCmp

The tape drive does not support byte comparison operations. The valid value for this bit must be 0.

Byte 01, Bit 0 – Fixed

Defines the type of verify operation to be performed, as follows:

0 – A single logical block is verified and the length of this block is specified in the Verification Length field.

1 – One or more fixed-length logical blocks are verified, and the number of blocks is specified in the Verification Length field. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT command (bytes 5 through 7 of the Block Descriptor).

> **Note:** The tape drive returns Check Condition status with the sense key set to Illegal Request (5h) if the Fixed field in the VERIFY command is 1 (fixed-length logical blocks) and the Block Length field in the current MODE SELECT data is 0 (variable-length logical block). The ASC and ASCQ bits are set to 81h and 00h (fixed/variable mismatch).

Bytes 02 through 04 – Verification Length

Defines the amount of data to be verified, as follows:

- When the Fixed bit is set to 0, the Verification Length field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 240 KB.

- When the Fixed bit is set to 1, the Verification Length field contains the number of logical blocks to be verified. The block length is the length specified with the MODE SELECT command.

Note: When the value for the Verification Length field is 0, no data is verified and the current position of the tape is not changed.

Byte 05, Bits 7 and 6 – Vendor Unique

There are now vendor unique definitions for these bits. The value for this field must be 0.

23.3   Exceptions and Error Conditions

The following exceptions and error conditions can occur with the VERIFY command.

Filemark Detected

If a filemark is detected before the verify operation is completed, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Depend on the setting of the Fixed bit, as follows: • If the Fixed bit is 0, equal the requested verification length. • If the Fixed bit is 1, equal the difference between the requested verification length and the actual number of logical blocks verified.
ASC	00h
ASCQ	01h
FSC	0Dh

When the VERIFY command terminates, the logical position is at the EOT side of the filemark.

Setmark Detected

If the RSmk bit in the MODE SELECT Device Configuration page (Page Code= 10h) is set to 1 and the tape drive detects a setmark before completing the verify operation, the tape drive returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Filemark	1
Sense Key	No Sense (0h)
Information bytes	Depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested verification length. ▪ If the Fixed bit is 1, equal the difference between the requested verification length and the actual number of logical blocks verified.
ASC	00h
ASCQ	03h
FSC	1Dh

When the VERIFY command terminates, the logical position is at the EOT side of the setmark encountered.

EOD Detected

If the tape drive detects EOD during the verify operation, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
Sense Key	Blank Check (8h)
Information bytes	Depend on the setting of the Fixed bit, as follows: ▪ If the Fixed bit is 0, equal the requested verification length. ▪ If the Fixed bit is 1, equal the difference between the requested verification length and the actual number of logical blocks verified.
ASC	00h
ASCQ	05h
FSC	0Ch

When the VERIFY command terminates, the logical position is after the last recorded data block, filemark, or setmark.

PEOT or PEOP Encountered

If the tape drive encounters the physical end of tape (PEOT) or the physical end of partition (PEOP) during a verify operation, it returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Medium Error (3h)
Information bytes	If Valid= 1, depend on the setting of the Fixed bit, as follows:
	▪ If the Fixed bit is 0, equal the requested verification length.
	▪ If the Fixed bit is 1, equal the difference between the requested verification length and the actual number of logical blocks verified.
ASC	3Bh
ASCQ	02h
PEOT	1
FSC	14h

When the VERIFY command terminates, the logical position is undefined.

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the verify operation, the tape drive terminates the VERIFY command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid= 1, depend on the setting of the Fixed bit, as follows:
	▪ If the Fixed bit is 0, equal the requested verification length.
	▪ If the Fixed bit is 1, equal the difference between the requested verification length and the actual number of logical blocks verified. The actual number does not include the unrecovered block.
Other bits and bytes	Depend on the error condition

When the VERIFY command is terminated, the tape is positioned after the unrecovered block for a Medium Error or in an undefined position for a Hardware Error.

Verification Length Incorrect

If the actual verification length does not match the requested verification length, the information reported depends on the setting of the Fixed bit.

Variable Length Mode (Fixed = 0)

If the Fixed bit is 0 and the actual length of the block on the tape does not match the verification length requested, the tape drive verifies the number of bytes available up to the verification length requested. Then, it terminates the VERIFY command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
ILI	1
Sense Key	No Sense (0h)
Information bytes	Indicate the difference between the actual length and the requested length: ▪ If the requested length is greater than the actual length, the Information bytes are positive. ▪ If the requested length is less than the actual length, the Information bytes are negative (2s complement notation)
ASC	00h
ASCQ	00h
FSC	0Ah

When the VERIFY command terminates in variable mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block).

Fixed Length Mode (Fixed = 1)

If the Fixed bit is 1 and the actual length of any one block does not match the requested block length, the tape drive verifies the number of blocks requested until it encounters the block with the incorrect length. Then, it terminates the VERIFY command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
ILI	1
Sense Key	No Sense (0h)
Information bytes	Indicate the number of blocks not verified, including the block with the incorrect length.
ASC	00h
ASCQ	00h
FSC	0Ah

When the VERIFY command terminates in fixed mode, the tape is positioned after the block with the incorrect length (at the start of the next logical block).

Illegal Requests

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

- The Fixed bit is set to 0 and the requested block length is greater than 240 KB.

- The Fixed bit is set to 1 and the block length in the MODE SELECT command is 0.

- A VERIFY command is issued immediately after a WRITE or WRITE FILEMARKS command has been executed.

- No data cartridge is loaded.

Notes

24 WRITE (0Ah)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	1	0	1	0
01	Logical Unit Number			Reserved				Fixed
02	(MSB)							
03				Transfer Length				
04								(LSB)
05	Vendor Unique			Reserved			0	0

24.1 About This Command

The WRITE command transfers one or more bytes or blocks of data from the initiator to the tape drive. Mammoth writes data to the tape in Mammoth format only. The data is compressed or uncompressed according to the setting of the DCE (data compression enable) bit in the MODE SELECT command (see).

When you issue a WRITE command at the beginning of tape, the tape drive automatically records an LBOT (logical beginning of tape) pattern before writing the data. The first track containing data blocks is recorded directly after the last track containing the LBOT information. You cannot alter or access the data contained in the LBOT blocks.

Note: If a read-after-write check indicates an error while the tape drive is writing LBOT, the blocks are not rewritten. Errors in writing the LBOT blocks are not reported to the initiator. If excessive read-after-write checks occur, the tape is rewound and the process is repeated. If the retry fails, a Medium Error is reported.

After writing data, the tape drive writes an end of data (EOD) mark to indicate the location of the last data on tape. The EOD mark is overwritten when additional data is appended to the last data on the tape.

24.2   Field Definitions

Byte 01, Bit 0 – Fixed

Defines the type of write operation you want the tape drive to perform, as follows:

0 –   Write a single logical block. The length of this block is specified in the Transfer Length field.

1 –   Write one or more fixed-length logical blocks. The number of blocks is specified in the Transfer Length field. The length of each block is either the power-on default block length or the length specified with the currently active MODE SELECT parameters (bytes 05 through 07 of the Block Descriptor).

Note: If the Fixed field in the WRITE command is 1 (fixed-length logical blocks) and the Block Length field in the current MODE SELECT data is 0 (variable-length logical block), the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The ASC and ASCQ bits are set to 81h and 00h (fixed/variable mismatch).

Bytes 02 through 04 – Transfer Length

Defines the amount of data you want the tape drive to write, as follows:

▪   When the Fixed bit is set to 0 (variable length), the Transfer Length field contains the length of the logical block in bytes. The logical block can be any size from 1 byte to 240 KB. (1 KB = 1,024 bytes.)

- When the Fixed bit is set to 1 (fixed length), the Transfer Length field contains the number of logical blocks to be written. The block length is the length specified with the MODE SELECT command. The allowable block sizes are defined by the READ BLOCK LIMITS (05h) command.

➤ **Important**   When the fixed bit is 1 and the block length is 1 or 2 bytes, the Transfer Length must be no more than 65,535 (1001Dh) logical blocks.

Note: When the value for the Transfer Length field is 0, no data is transferred and the current position of the tape is not changed.

Byte 05, Bits 7 and 6 – Vendor Unique

There are no vendor unique definitions for this command. The value for this field must be 0.

24.3   Tape Positioning

This section describes the legal tape positions for a write operation.

Tape Positioned at LBOT or LBOP

When writing to a tape positioned at LBOT or LBOP, the tape drive automatically writes a new LBOT (or LBOP) pattern and then writes the data from the buffer.

Appending Data

When writing to tape, the tape drive can append new data to existing data at certain locations only. If the tape is not positioned at a legal location, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The legal locations for appending data are:

- EOD mark (the EOD mark is overwritten as new data is appended)
- Beginning or end of a long filemark
- Beginning or end of a setmark

Note: If data is appended at the beginning of a long filemark or setmark, the filemark or setmark is overwritten.

24.4 Data Buffering

The tape drive provides two modes of operation for the WRITE command: unbuffered and buffered. The mode of operation is set with the MODE SELECT command (byte 02, bits 6 through 4, in the Parameter List Header).

Unbuffered Write Operation

When the tape drive is set for an unbuffered write operation, it returns Good status as soon as all data blocks are written to tape.

Buffered Write Operation

When the tape drive is set for a buffered write operation, it returns Good status as soon as all data blocks are successfully transferred to the buffer. The data in the buffer is written to tape when one of the following conditions occurs:

- The motion threshold is reached during a WRITE command (see Section 2.5).

- The tape drive receives one of the following commands:

  - REWIND (01h)
  - WRITE FILEMARKS (10h) non-immediate
  - SPACE (11h) in either direction
  - ERASE (19h)
  - LOAD/UNLOAD (1Bh)
  - LOCATE (2Bh)

- The operator presses the unload button.

- The time specified for the Write Delay Time field in the MODE SELECT command elapses (note, however, if the Write Delay Time field is 0, a partially full buffer is not flushed to tape). See page 9-34 for more information about Write Delay Time.

24.5 Exceptions and Error Conditions

The following exceptions and error conditions can occur with the WRITE command.

Write-Protected Data Cartridge

If a write operation is attempted on a data cartridge that is write protected, the tape drive returns Check Condition status with the sense key set to Data Protect (7h).

LEOT or LEOP Encountered

As described in Table 24-1, if the logical end of tape (LEOT) or logical end of partition (LEOP) is encountered during a WRITE command, the action of the tape drive depends on the setting of the Fixed bit in the current CDB.

Table 24-1 Action if LEOT or LEOP is encountered during a WRITE command

	Setting of Fixed bit in current CDB	
	Fixed= 0 **(variable-length logical block)**	**Fixed= 1** **(fixed-length logical blocks)**
LEOT or LEOP encountered during write operation	The tape drive returns Check Condition status after all data has been written to tape. The extended sense data is set as follows: ▪ Error Code= 70h ▪ EOM= 1 ▪ Sense Key= 0h (No Sense) ▪ LBOT= 0	The tape drive returns Check Condition status after all data in the buffer and the block currently being transferred has been written to tape. The extended sense data is set as follows: ▪ Valid= 1 ▪ Error Code= 70h ▪ EOM= 1 ▪ Sense Key= 0h (No Sense) ▪ Information bytes= requested transfer length – actual number of blocks written to tape ▪ LBOT= 0

WRITE Command Issued after LEOT or LEOP Encountered

Issuing a WRITE command after LEOT or LEOP is encountered causes the tape drive to go into unbuffered mode and to return Check Condition status after writing as much data as possible. The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	No Sense (0h)
Information bytes	The value depends on the setting of the Fixed bit as follows:
	▪ If the Fixed bit is 0, the Information bytes are always 0.
	▪ If the Fixed bit is 1, the Information bytes are 0 if all the data was written to tape. If all the data was not written, the Information bytes equal the difference between the requested transfer length and the actual number of logical blocks written.
ASC	00h
ASCQ	00h
LBOT	0

Note: If the data transfer stops before it is completed, it terminates on a logical block boundary.

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Sense Key	Volume Overflow (Dh) bytes
Information Bytes	If Valid= 1, depend on the setting of the Fixed bit, as follows: • If the Fixed bit is 0, the Information bytes equal the requested transfer length. • If the Fixed bit is 1, the Information bytes equal the difference between the requested transfer length and the actual number of logical blocks written.
ASC	00h
ASCQ	02h
PEOT	1
FSC	AFh

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the write operation, the tape drive terminates the WRITE command and returns Check Condition status. Data that remains in the buffer is not written to tape. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid= 1, depend on the setting of the Fixed bit, as follows:
	▪ If the Fixed bit is 0, equal the requested transfer length.
	▪ If the Fixed bit is 1, equal the difference between the requested transfer length and the actual number of logical blocks written.
Other bits and bytes	Depend on the error condition

Note: If another WRITE command is issued after an unrecoverable error occurs, the tape drive returns Check Condition status with the sense key set to Medium Error or Hardware Error and the command is not executed.

Illegal Requests

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

▪ The Fixed bit is set to 0 and the requested block length is greater than 240 KB.

▪ The Fixed bit is set to 1 and the block length in the MODE SELECT command is 0.

▪ The tape position is invalid.

▪ The tape is not an AME tape.

▪ You have attempted to write in a non-Mammoth format.

25 WRITE BUFFER (3Bh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	0	1	1
01	Logical Unit Number			Reserved		Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Parameter List Length							
08								(LSB)
09	WBF	0	Reserved				0	0

25.1   About This Command

The WRITE BUFFER command allows you to load new microcode from a file into the tape drive's control memories across the SCSI bus. You can obtain microcode update files on diskettes from Exabyte Technical Support, or you can download microcode files from the Exabyte Technical Support bulletin board or World Wide Web site (http://www.exabyte.com).

Note: You can also obtain microcode updates on 8mm tape. When using an 8mm microcode update tape, you do not need to use the WRITE BUFFER command. See Appendix C for instructions for using a microcode update tape.

Using One or More WRITE BUFFER Commands

You have the option of issuing one WRITE BUFFER command or a sequence of WRITE BUFFER commands to load microcode into your tape drive. If you use just one WRITE BUFFER command, you specify the exact length of the microcode file on your host system with the command. If you use multiple WRITE BUFFER commands, you specify partial lengths of the microcode file with each command. The total of the lengths you specify in a sequence of WRITE BUFFER commands must add up to the total length of the microcode file on your host system.

Note: The Mammoth microcode file size is approximately 1 MB. However, the size of the microcode file you will be loading into your tape drive may be different once it is on your host system. The size of the file on your host system is the size you use when issuing the WRITE BUFFER command or command sequence.

How the Tape Drive Performs the Write Buffer Operation

When the tape drive receives a WRITE BUFFER command, it enters a write buffer mode that prevents the execution of all SCSI commands except WRITE BUFFER, REQUEST SENSE, and INQUIRY. All other commands result in Check Condition status with the sense key set to Aborted Command (Bh) and an FSC of EBh. The write buffer operation is terminated and partially received microcode is discarded. To prevent termination of the write buffer operation, reserve the tape drive for the initiator's exclusive use before issuing WRITE BUFFER commands.

After the WRITE BUFFER command or command sequence is executed, the microcode is transferred from the SCSI bus to the tape drive's RAM buffer. Then, the image in the buffer is validated. During validation, the microcode is checked for the correct header and internal format, the proper number of files, and whether the tape drive's hardware and boot code support the new microcode. If the new microcode passes these tests, it is loaded into the tape drive's control memories. The machine state (including MODE SELECT parameters) is set to the new power-on defaults, and the tape drive performs its power-on self-test.

After the new code has been loaded successfully, the tape drive terminates the write buffer mode and returns Good status to the initiator that issued the WRITE BUFFER command or command sequence. The tape drive returns Check Condition status with the sense key set to Unit Attention (6h) to commands sent by other initiators. The ASC and ASCQ fields will be set to 3Fh and 01h, and the Fault Symptom Code will be C3h (New microcode loaded).

Tape Present During WRITE BUFFER Execution

If a tape is loaded when the tape drive receives a WRITE BUFFER command, the tape drive flushes any buffered write data to the tape. When all of the WRITE BUFFER commands have been received, the tape drive unloads the tape but does not eject it. After the code load has completed successfully, the tape is reloaded. If the code load fails, the tape is reloaded and positioned at the original location.

Cautions for Using the WRITE BUFFER Command

Be sure to follow these cautions when issuing the WRITE BUFFER command.

CAUTION

Be sure to heed these cautions when issuing the WRITE BUFFER command:

- The WRITE BUFFER command allows you to load new microcode from the SCSI bus into the tape drive. It is not intended to be used for testing tape drive functionality (that is, do not issue this command unless you are actually loading new microcode).

- Be sure that the tape drive is reserved for the initiator's exclusive use while WRITE BUFFER commands are executing.

- Do not power off the tape drive while WRITE BUFFER commands are executing.

If a hardware failure or power failure occurs during the execution of this command, the tape drive may not be able to operate. If this occurs, you can use the Mammoth Monitor program to reload microcode (from a *.i file) through a serial cable attached to the tape drive's Monitor port. (See the documentation for Mammoth Monitor for complete instructions.)

Aborting a Write Buffer Operation

If necessary, you can abort a write buffer operation by sending an Abort message to the tape drive or resetting the tape drive. Then, you can reissue the WRITE BUFFER command or the entire sequence of WRITE BUFFER commands.

➤ **Important**   Once all of the microcode has been transferred and the tape drive has started loading it into memory, SCSI bus reset and selection are disabled for the tape drive.

25.2   Field Definitions

Byte 01, Bits 2 through 0 – Mode

There are two modes for loading microcode: 101b and 111b. Both modes allow you to use multiple WRITE BUFFER commands. The two modes differ only in the use of the WBF bit (byte 09, bit 7) when you are using multiple WRITE BUFFER commands. Mode 111b is the preferred method.

Instructions for using Mode 101b begin on . Instructions for using Mode 111b begin on .

Byte 02 – Buffer ID

Must be 0.

Bytes 03 through 05 – Buffer Offset

The value you specify for the Buffer Offset field depends on whether you are issuing one WRITE BUFFER command or several WRITE BUFFER commands, as follows:

▪ If you are using one WRITE BUFFER command, set this field to 0.

▪ If you are using more than one WRITE BUFFER command, set this field to the sum of the Buffer Offset and Parameter List Length from the previous WRITE BUFFER command. This sum must not exceed the length of the microcode file.

Bytes 06 through 08 – Parameter List Length

Specifies the number of bytes to be transferred by the current WRITE BUFFER command. The value you specify for this field depends on whether you are issuing one WRITE BUFFER command or several WRITE BUFFER commands, as follows:

- If you using only one WRITE BUFFER command, specify the exact length of the microcode file on your host system in bytes. (Note that Mammoth microcode files may differ in length from one release to the next.)

- If you are using more than one WRITE BUFFER command, specify a multiple of 100h for each Parameter List Length (must be greater than 0). Then, for the last WRITE BUFFER command in the sequence, set the Parameter List Length to the remaining length.

Note: The Parameter List Length must not exceed the size of the code load file minus the Buffer Offset. If the Parameter List Length is greater than the maximum allowed by the tape drive, a Check Condition status results with a sense key of Illegal Request.

Byte 09, Bit 7 – WBF (WRITE BUFFERs Follow)

If you are using Mode 101b, this bit specifies whether the new microcode is being sent using one or more WRITE BUFFER commands, as follows:

0 – This is the only WRITE BUFFER command, or this is the last WRITE BUFFER command in a sequence.

1 – This is one of several (but not the last) WRITE BUFFER commands in a sequence.

Note: If you are using Mode 111b, set the WBF bit to 0 for all WRITE BUFFER commands. The microcode file has a delimiter that the tape drive looks for in this mode to determine the end of the file.

25.3   Loading Microcode Using Mode 101b

To load microcode using Mode 101b, follow the steps outlined below.

Note: You can use one or more WRITE BUFFER commands to transfer the microcode. If you use more than one WRITE BUFFER command, the Parameter List Length value you specify with each WRITE BUFFER command must indicate only the amount of data you are transferring with that command, not the total length of the microcode file. The sum of the Parameter List Lengths from all the WRITE BUFFER commands you issue must add up to the total length of the microcode file on your host system.

1. Send the WRITE BUFFER command with the following settings:

Mode:	101b
Buffer ID:	00h
Buffer Offset:	000000h
Parameter List Length:	Number of bytes to be sent (must be greater than 0 and must be a multiple of 100h)
WBF:	0 if you are using just one WRITE BUFFER command.
	1 if you are using additional WRITE BUFFER commands.

2. Transfer the number of bytes specified by the Parameter List Length from the microcode file.

Wait for the status and the Command Complete message. If the status is not Good, issue a REQUEST SENSE command. If the write buffer mode requires termination, issue a TEST UNIT READY command.

If there is more microcode to be transferred, proceed with step 3. If not, the code load is finished.

3. Send the next WRITE BUFFER command with the following settings:

Mode:	101b
Buffer ID:	00h
Buffer Offset:	Previous Buffer Offset plus previous Parameter List Length. (This sum must not exceed the length of the microcode file.)
Parameter List Length:	Number of bytes to be sent. (This value must be greater than 0 and, unless this is the last transfer, must be a multiple of 100h. If this is the last transfer, set this value to the remaining length.)
WBF:	0 if this is the last WRITE BUFFER command.
	1 if additional WRITE BUFFER commands follow.

Wait for the status and the Command Complete message as before.

If more microcode remains, repeat this step until all of the microcode has been transferred.

25.4 Loading Microcode Using Mode 111b

To load microcode using Mode 111b, follow the steps outlined below.

Note: You can use one or more WRITE BUFFER commands to transfer the microcode. If you use more than one WRITE BUFFER command, the Parameter List Length value you specify with each WRITE BUFFER command must indicate only the amount of data you are transferring with that command, not the total length of the microcode file. The sum of the Parameter List Lengths from all the WRITE BUFFER commands you issue must add up to the total length of the microcode file on your host system.

1. Send the WRITE BUFFER command with the following settings:

Mode:	111b
Buffer ID:	00h
Buffer Offset:	000000h
Parameter List Length:	Number of bytes to be sent (must be greater than 0 and must be a multiple of 100h)
WBF:	0

2. Transfer the number of bytes specified by the Parameter List Length from the microcode file.

   Wait for the status and the Command Complete message. If the status is not Good, issue a REQUEST SENSE command. If the write buffer mode requires termination, issue a TEST UNIT READY command.

   If there is more microcode to be transferred, proceed with step 3. If not, the code load is finished.

3. Send the next WRITE BUFFER command with the following settings:

Mode:	111b
Buffer ID:	00h
Buffer Offset:	Previous Buffer Offset plus previous Parameter List Length. (This sum must not exceed the length of the microcode file.)
Parameter List Length:	Number of bytes to be sent. (This value must be greater than 0 and, unless this is the last transfer, must be a multiple of 100h. If this is the last transfer, set this value to the remaining length.)
WBF:	0

Wait for the status and the Command Complete message as before.

If more microcode remains, repeat this step until all of the microcode has been transferred.

25.5   Exceptions and Error Conditions

The following exceptions and errors can occur with the WRITE BUFFER command.

Illegal Value in WRITE BUFFER CDB

If a WRITE BUFFER command is issued with an illegal parameter, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h). The Fault Symptom Code (FSC) is set to CEh (Illegal value in CDB). If the tape drive is already in write buffer mode, it remains in this mode. If the tape drive is not in write buffer mode, it does not enter this mode.

Illegal WRITE BUFFER Data

If data transferred by the WRITE BUFFER command is invalid, the tape drive terminates the write buffer mode and returns a sense key of Aborted Command (0Bh) with an ASC of 26h and an ASCQ of 00h. The Fault Symptom Code is one of the following:

FSC	Description
61h	The file header or format is invalid.
63h	The image for the FE section is invalid.
65h	The image for the EE section is invalid.
69h	The file CRC is incorrect.

Downlevel Boot Code PROM

If the tape drive's boot PROM is not compatible with the new microcode, the tape drive returns Check Condition status with a sense key of Illegal Request (5h) and an FSC of 66h. The ASC is 26h and the ASCQ is 01h. The boot PROM must be updated to accommodate the new microcode level.

Aborted Write Buffer Operation

If the initiator that began the write buffer operation issues any SCSI command to the tape drive other than WRITE BUFFER, REQUEST SENSE, and INQUIRY, the write buffer operation is aborted. The tape drive returns Check Condition status with a sense key of Aborted Command (Bh) and an FSC of EBh.

If another initiator issues any SCSI command to the tape drive during the write buffer operation, the tape drive returns Check Condition status with a sense key of Bh and an FSC of EBh, but does not abort the write buffer operation.

Fatal Load Error

Once the load process is started, it is irreversible. If a hardware or power failure occurs during the load operation, the tape drive may not be able to operate. In this event, you can use the Mammoth Monitor program to reload the microcode through the Monitor port (refer to the documentation for Mammoth Monitor for instructions).

Illegal Command During WRITE BUFFER Operation

If you issue a command other than WRITE BUFFER, INQUIRY, or REQUEST SENSE to the tape drive during a WRITE BUFFER command sequence, the tape drive terminates the command with Check Condition status and terminates the WRITE BUFFER sequence. The sense key is set to Aborted Command (Bh), and the ASC and ASCQ are set to 00h. The Fault Symptom Code is set to EBh.

Notes

26 WRITE FILEMARKS (10h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	0	0
01	Logical Unit Number			Reserved			WSmk	Immed
02	(MSB)							
03				Number of Filemarks				
04								(LSB)
05	Short	VU	Reserved				0	0

26.1 About This Command

The WRITE FILEMARKS command causes the tape drive to write any data remaining in the buffer to tape and then to write one or more filemarks or setmarks to tape.

Note: Filemarks and setmarks can be buffered. Each buffered filemark or setmark uses 1 KB of the tape drive's buffer.

26.2 Field Definitions

Byte 01, Bit 1 – WSmk (Write Setmark)

Specifies whether you want the tape drive to write setmarks or filemarks at the current position, as follows:

0 – Write filemarks at the current position
1 – Write setmarks at the current position

Byte 01, Bit 0 – Immed

Determines when command status is returned to the initiator and whether buffered filemarks and setmarks will remain in the buffer, as follows:

0 – Status is reported to the initiator when the WRITE FILEMARKS command is completed. All buffered data, filemarks, and setmarks are written to the tape before the command is completed.

1 – Status is reported to the initiator when the WRITE FILEMARKS command is initiated by the tape drive. This mode is valid only if the tape drive is operating in buffered mode (the Buffered Mode field is set to 001b in the MODE SENSE parameter header). This setting does not flush the buffer.

Bytes 02 through 04 – Number of Filemarks

Specifies the number of filemarks (or setmarks) to be written to tape. A value of 0 is not an error and results in either of the following:

- If the Immed bit is 0, no filemarks (or setmarks) are transferred and the data in the buffer is written to the tape.

- If the Immed bit is 1, no operation is performed and Good status is returned.

Byte 05, Bit 7 – Short

Determines the size of the filemark written to tape, as follows:

0 – Write a long filemark.
1 – Write a short filemark.

Note: If WSmk bit is 1 (write setmarks), the Short bit is ignored.

Byte 05, Bit 6 – VU (Vendor Unique)

There is no vendor unique definition for this bit. The value for this bit must be 0.

26.3   Tape Positioning

This section describes the legal tape positions for a write filemarks operation.

Tape Positioned at LBOT or LBOP

When writing to a tape positioned at the logical beginning of tape (LBOT) or at the logical beginning of partition (LBOP), the tape drive automatically writes a new LBOT pattern and then writes the requested number of filemarks (or setmarks).

Appending Data

The tape drive can append filemarks (or setmarks) to existing data as long as the tape is positioned at one of the following locations:

- End of data (EOD) mark
- Beginning or end of a long filemark
- Beginning or end of a setmark

If the tape is not positioned at one of these locations, the tape drive returns Check Condition status with the sense key set to Illegal Request (5h).

26.4   Exceptions and Error Conditions

The following exceptions and error conditions can occur with the WRITE FILEMARK command.

Write-Protected Data Cartridge

If a write filemarks operation is attempted on a data cartridge that is write protected, the tape drive returns Check Condition status with the sense key set to Data Protect (7h).

LEOT or LEOP Encountered

If the logical end of tape (LEOT) or logical end of partition (LEOP) is encountered, the tape drive attempts to write all of the filemarks (or setmarks) requested and then returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	1
EOM	1
Sense Key	No Sense (0h)
Information bytes	Contain the difference between the requested number of filemarks (or setmarks) and the actual number of filemarks (or setmarks) written. A value of 0 indicates that all filemarks (or setmarks) were written to tape.
ASC	00h
ASCQ	02h
LBOT	0
PEOT	0
FSC	28h

If you issue a WRITE FILEMARKS command after LEOT or LEOP is encountered, the tape drive returns Check Condition status after the command is completed. The REQUEST SENSE data is set as shown above.

PEOT or PEOP Encountered

If the physical end of tape (PEOT) or physical end of partition (PEOP) is encountered, the tape drive terminates the WRITE FILEMARKS command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
EOM	1
Information bytes	If Valid= 1, contain the difference between the requested number of filemarks (or setmarks) and the actual number of filemarks (or setmarks) written.
Sense Key	Volume Overflow (Dh)
ASC	00h
ASCQ	02h
PEOT	1
FSC	AFh

Unrecoverable Error

If an unrecoverable media or hardware error occurs during the write filemarks operation, the tape drive terminates the WRITE FILEMARKS command and returns Check Condition status. The REQUEST SENSE data is set as follows:

Valid	0 or 1
Sense Key	Medium Error (3h) or Hardware Error (4h)
Information bytes	If Valid= 1, contain the difference between the requested number of filemarks (or setmarks) and the actual number of filemarks (or setmarks) written.
Other bits and bytes	Depend on the error condition

Note: If another WRITE FILEMARKS command is issued after an unrecoverable error occurs, the tape drive returns Check Condition status with the sense key set to Medium Error or Hardware Error and the command is not executed.

Illegal Requests

The following conditions cause the tape drive to return Check Condition status with the sense key set to Illegal Request (5h):

- The tape position is invalid.
- The tape is not an AME tape.
- You have attempted to write in a non-Mammoth format.

A SCSI Message Processing and Error Recovery

This appendix describes the message processing and error handling by the tape drive and the appropriate initiator response when error conditions are detected during different SCSI bus phases. The errors and responses are separated into two categories:

- Errors and responses for initiators that support only the Command Complete message.

- Errors and responses for initiators that support the messages described on in addition to the Command Complete message.

A.1   Initiator Only Supports the Command Complete Message

This section describes the actions to be taken by the initiator and the tape drive when a SCSI bus parity error occurs and the initiator only supports the Command Complete message.

Parity Error in Command Out Phase

When parity checking is enabled and the tape drive detects a parity error during the Command Out phase, it immediately sends Check Condition status to the initiator, followed by a Command Complete (00h) message. The sense key is set to Aborted Command (Bh) and the SCSI Bus Parity Error (BPE) bit is set to 1. The initiator should reissue the command.

Parity Error in the Data Out Phase

When parity checking is enabled and the tape drive detects a parity error in the user data associated with the WRITE command, it aborts the data transfer.

When this condition occurs, the tape drive immediately sends Check Condition status to the initiator, followed by a Command Complete (00h) message. The sense key is set to Aborted Command (Bh) and the SCSI Bus Parity Error (BPE) bit is set to 1. The initiator may be able to recover by reissuing the WRITE command.

Parity Error in the Data In Phase

If the parity error is detected in the user data associated with a READ command, the initiator should do a backspace-n-blocks operation and set up to reread the blocks by reissuing the command.

If the parity error is detected during the execution of any other data command (for example, during sense operations), it is only necessary to reissue the command. If the command was REQUEST SENSE, valid sense data will be returned because the sense data is not reset until the next non-REQUEST SENSE or non-INQUIRY command is issued.

A.2 Initiator Supports Messages in Addition to the Command Complete Message

This section describes the tape drive message processing and SCSI bus error recover for initiators supporting messages in addition to Command Complete. It includes a number of charts showing the actions that the tape drive will take in response to each message it receives from the initiator.

The charts are organized by phase transitions; that is, there is a chart for each possible initial phase with the transition to the Message Out phase. The charts indicate the specific action the tape drive will take for each type of message. The text accompanying each chart also describes the actions to be taken by the initiator and the tape drive if a SCSI bus parity error occurs.

Tape Drive Response to the Attention Signal

Once the physical path management mechanism has been established by the initiator using the Identify message, the tape drive will accept and process messages from the initiator whenever the Attention signal is driven true. The tape drive will respond to the Attention signal for each SCSI bus phase as described in Table A-1.

Table A-1 Responses to the Attention signal

If the initiator asserts the Attention signal during this phase...	The tape drive responds...
Selection	Immediately following the selection. **Note:** If parity checking is enabled and the tape drive detects a parity error during the Selection phase, it ignores the selection.
Command	At the end of the phase, after all CDB bytes have been received.
Data In	After a number of bytes (up to 10h) have been transferred to the initiator.
Data Out	After a number of bytes (up to 10h) have been transferred from the initiator.
Status	After the Status byte has been received by the initiator.
Message In	After the next message byte has been received by the initiator.
Message Out	After the next message byte has been received by the tape drive (will stay in Message Out phase).

Message Processing after the Selection Phase

Figure A-1 shows that the tape drive will only accept three legal messages immediately after the Selection phase (Abort, Reset, and Identify).

Parity Error in the Selection Phase

When parity checking is enabled and the tape drive detects a parity error during the Selection phase, it stays in the Message Out phase until the Attention signal goes low. Then, it retries by going to the Message Out phase again. If a parity error is detected the second time the message is received, the tape drive goes to the Bus Free phase by releasing the BSY signal.

Inital Phase: Selection
Transition to: Message Out

```
┌──────────┐     ┌──────────┐     ┌──────────┐
│  Reset   │     │  Abort   │     │ All Others│
└──────────┘     └──────────┘     └──────────┘
     │                │                │
     ▼                ▼                ▼
┌──────────┐     ┌──────────┐     ┌──────────┐
│Go Bus Free│    │Go Bus Free│    │Go Bus Free│
└──────────┘     └──────────┘     └──────────┘
     │
     ▼
┌──────────────┐
│Execute warm reset│
└──────────────┘
```

```
                    ┌──────────┐
                    │ Identify │
                    └──────────┘
                          │
                          ▼
            Yes    ◇ Is Disconnect ◇    No
         ┌─────────│   bit set?    │─────────┐
         ▼         ◇               ◇         ▼
  ┌──────────────┐                    ┌──────────────┐
  │Allow disconnects│                 │  Disallow    │
  └──────────────┘                    │ disconnects  │
         │                            └──────────────┘
         └──────────────┬────────────────────┘
                        ▼
            Yes    ◇ Is LUN valid ◇    No
         ┌─────────│  (equal 0)?   │─────────┐
         ▼         ◇               ◇         ▼
  ┌──────────────┐                    ┌──────────────┐
  │Clear invalid LUN│                 │ Set invalid LUN│
  │     flag      │                   │     flag      │
  └──────────────┘                    └──────────────┘
         │                                   │
         └──────────────┬────────────────────┘
                        ▼
            Yes    ◇ Is Attention high? ◇    No
         ┌─────────│                  │─────────┐
         ▼         ◇                  ◇         ▼
  ┌──────────────┐                    ┌──────────────┐
  │Stay in Message│                   │ Go to CDB In  │
  │  Out phase    │                   │    phase      │
  └──────────────┘                    └──────────────┘
```
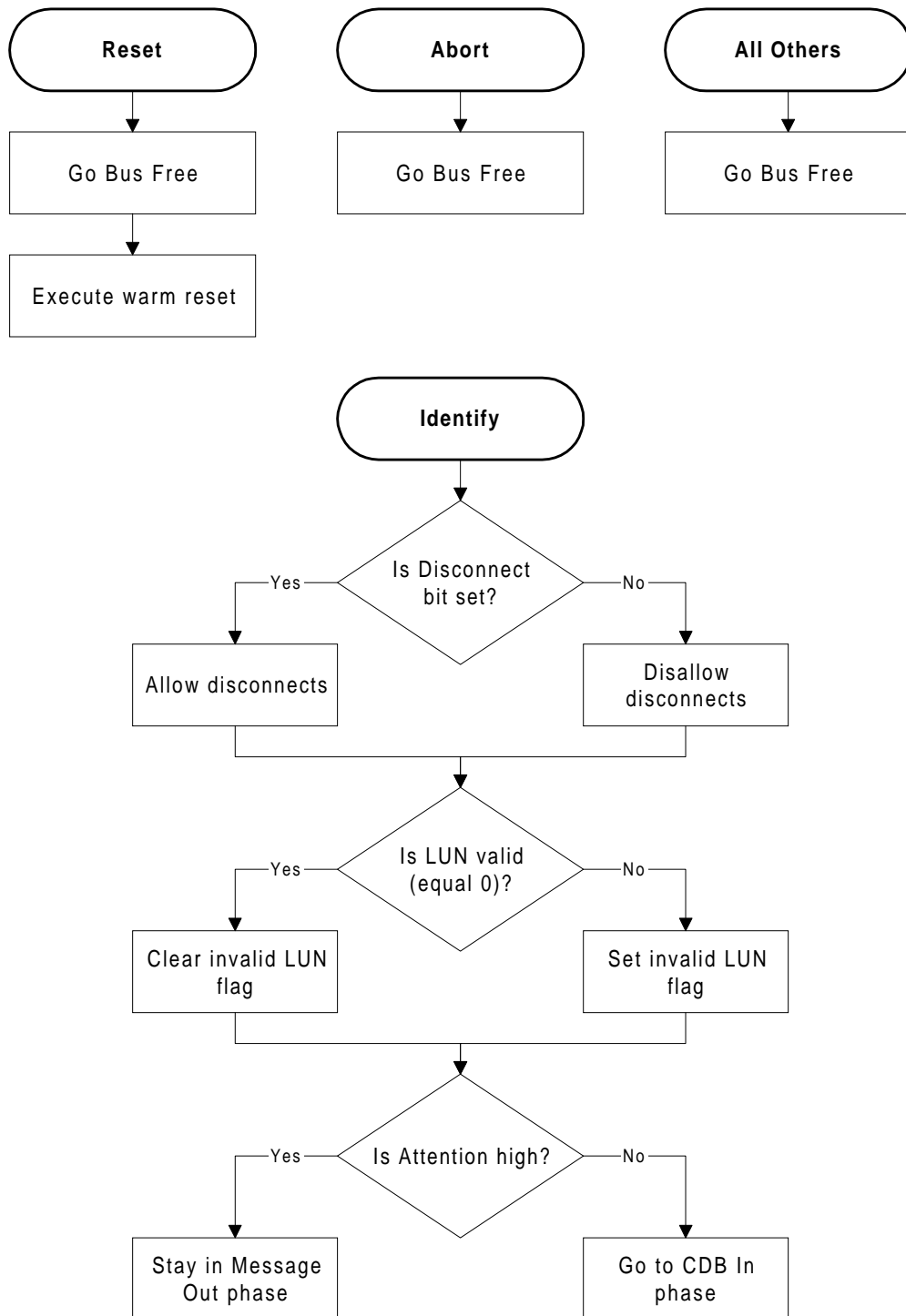
Figure A-1   Message processing after the Selection phase

Message Processing in the Message Out Phase

Figure A-2 shows the message sequences for Message Out bytes received during a previously initiated Message Out phase. Note that Message Reject and Initiator Detected Error messages received after a previous Message Out phase are treated as catastrophic errors committed by the initiator.

Parity Error in the Message Out Phase

When parity checking is enabled and the tape drive detects a parity error in a message received from the initiator, the tape drive requests that the initiator reissue the message by going to the Message Out phase again.

If a parity error occurs during the first message sequence (Identify message followed by contiguous Message Out bytes), the entire sequence must be retransmitted (that is, the initiator should reissue the Identify message and all following bytes). If a parity error is detected the second time the message is received, the tape drive goes to the Bus Free phase by releasing the BSY signal.

Inital Phase: Message Out
Transition to: Message Out

```
Reset                          Abort                                    Identify
  │                              │                                        │
  ▼                              ▼                                        ▼
Go Bus Free               ╱ Does initiator ╲                        ╱ LUN ╲──Yes──┐
  │                      ╱  own current      ╲                      ╲ Change? ╱    │
  ▼                      ╲  process?         ╱                        │ No        ▼
Execute warm reset        ╲                ╱                          ▼       Go Bus Free
                            │ Yes      │ No                    ╱ Is Disconnect ╲
                            ▼          │              Yes──── ╲ bit set?      ╱ ────No
                        Abort Process  │               │        ╲          ╱        │
                            │          │               ▼                            ▼
                            ▼          ▼           Allow disconnects          Disallow
                        Go Bus Free ◄──┘               │                      disconnects
                                                       │        Continue          │
                                                       └──────► processing ◄──────┘
```

```
No Operation            Extended Message          Initiator Detected          All Others
  │                        │                            Error                     │
  ▼                        ▼                              │                        ▼
Continue processing   Process Extended                   ▼                  Send Message
                      message                    Set sense key to            Reject In
                                                 Aborted Command                 │
Message Parity                                   (Bh)                            ▼
Error                                              │                       Continue processing
  │                                                ▼
  ▼                                        Go to Status phase
Set sense key to                           Send Check Condition
Aborted Command
(Bh)
  │
  ▼
Go Bus Free
```

Figure A-2   Message Out bytes received after previous Message Out phase

CDB Processing During the Command Out Phase

Figure A-3 shows how CDB bytes are processed. If the initiator asserts the Attention signal during the Command Out phase, the tape drive waits until all CDB bytes have been received and then goes to the Message Out phase.

The Group Code is the upper three bits of the first CDB byte. The OP Code is the lower five bits of the first CDB byte. The Group Code determines how many CDB bytes are to be transmitted by the specifying one of the following groups:

Group 0	Six-byte commands
Group 1	Ten-byte commands
Group 2	Ten-byte commands
Group 3	Six-byte commands
Group 4	Six-byte commands
Group 5	Twelve-byte commands
Group 6	Six-byte commands
Group 7	Ten-byte commands

Parity Error in Command Out Phase

If a parity error is detected in the CDB byte being sent by the initiator, the tape drive goes to the Message In phase and sends a Restore Data Pointers message. Then, the tape drive transitions to the Command Out phase and tries to process the CDB again. If this retry process occurs 15 times (16 times total), the tape drive goes to Status phase and returns Check Condition status. The sense key is set to Aborted Command (Bh) and the ASC and ASCQ are set to 43h and 00h. The Fault Symptom Code is set to E0h.
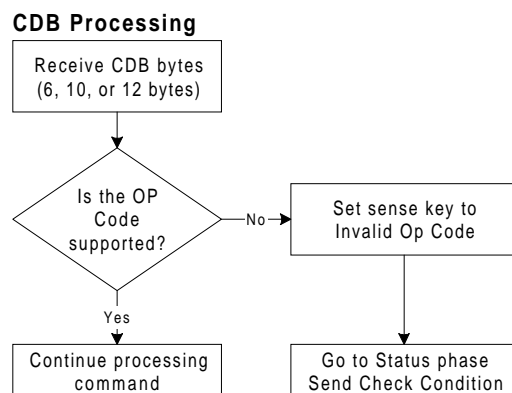
CDB Processing

Figure A-3 Processing of CDB bytes

Message Processing in the Message Out Phase after Command Phase

Figure A-4 shows how messages are processed after the Command phase and before any Data phase. This processing is the same as that in Figure A-2. Message sequences that are legal before the CDB is received are also legal after the CDB is received.

If the tape drive detects a parity error in the Command Out phase, it sends a Restore Data Pointers message to the initiator. Figure A-5 shows how messages are processed after a Restore Data Pointers message during the Command Out phase.

Parity Error in the Message Out Phase

When parity checking is enabled and the tape drive detects a parity error in a message received from the initiator, the tape drive goes to the Message Out phase again to request that the initiator reissue the message.

Inital Phase: Message Out
Transition to: Message Out
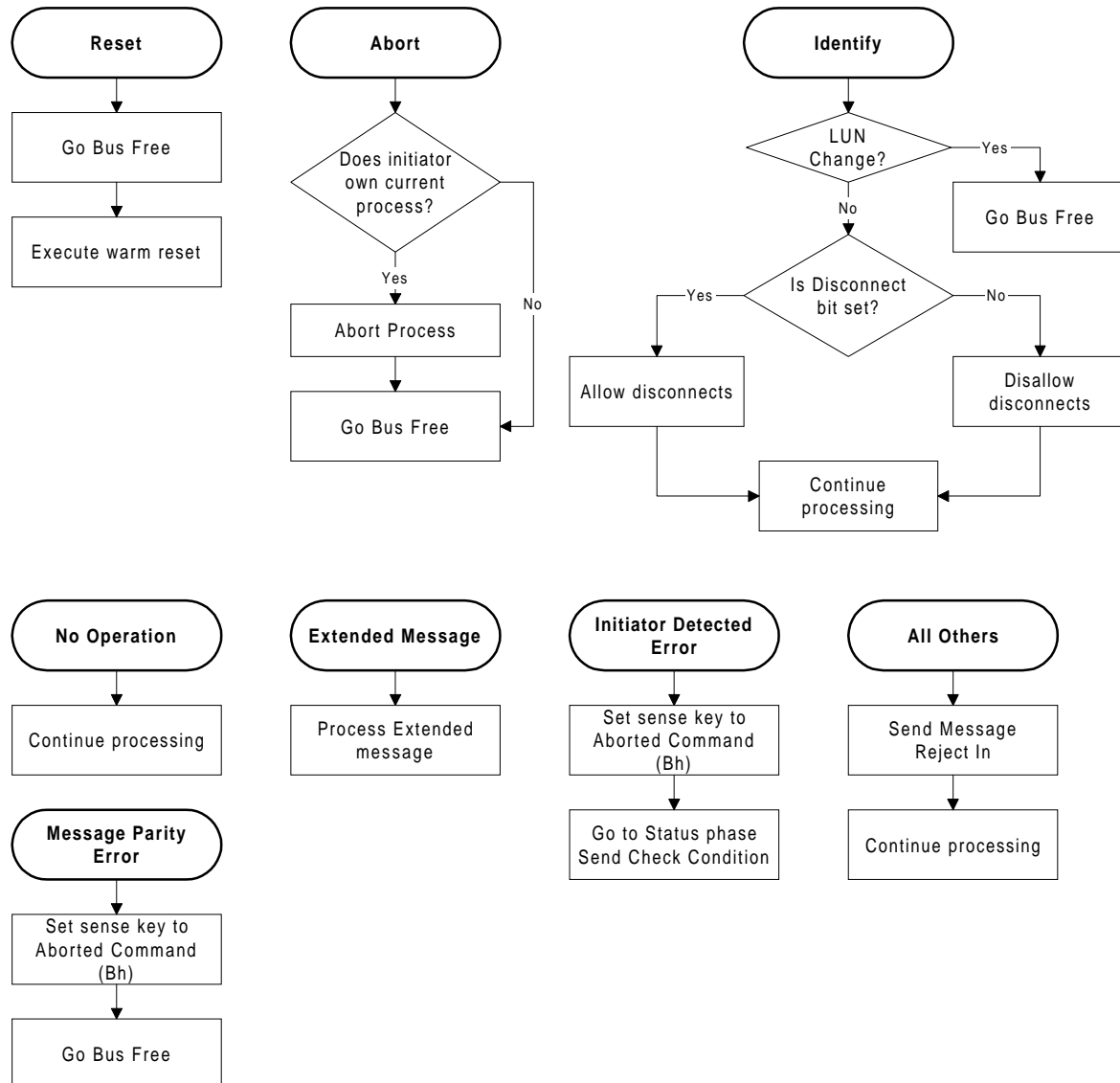
Figure A-4 Message processing after the Command phase and before the Data In phase

Inital Phase: Message In (Restore Data Pointers)
Transition to: Message Out
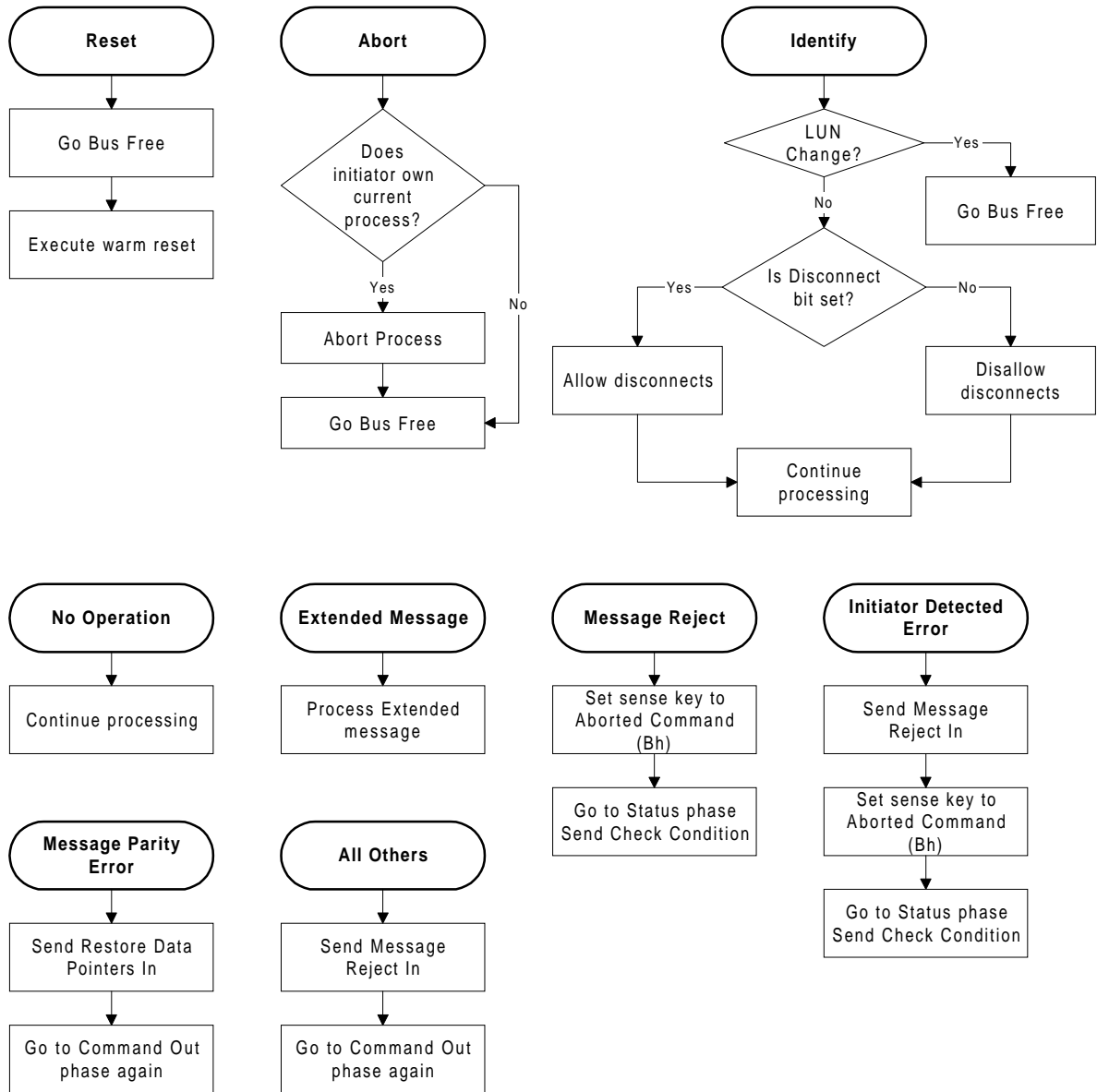
Figure A-5   Message processing after a Restore Data Pointers message when attempting to retry the Command Out phase

Processing of Extended Message Out

Figure A-6 shows how Extended Message Out messages are processed. Note that the Attention signal must coincide with the message byte numbering sequence. The tape drive responds to the initiator's Synchronous Data Transfer Request with a transfer period of *xx* or 19h (100 nanoseconds), whichever is larger (slower), and a REQ/ACK offset of *yy* or Fh (15), whichever is smaller.

Parity Error in Extended Message Out

When parity checking is enabled and the tape drive detects a parity error in the Synchronous Data Transfer Request message received from the initiator, the tape drive stays in the Message Out phase until the Attention signal goes low. Then, it goes to the Message Out phase again to request that the initiator reissue the entire message sequence.

If a parity error is detected the second time the extended message is received, the tape drive goes to the Bus Free phase by releasing the BSY signal.

Extended Message Processing (message bytes out)
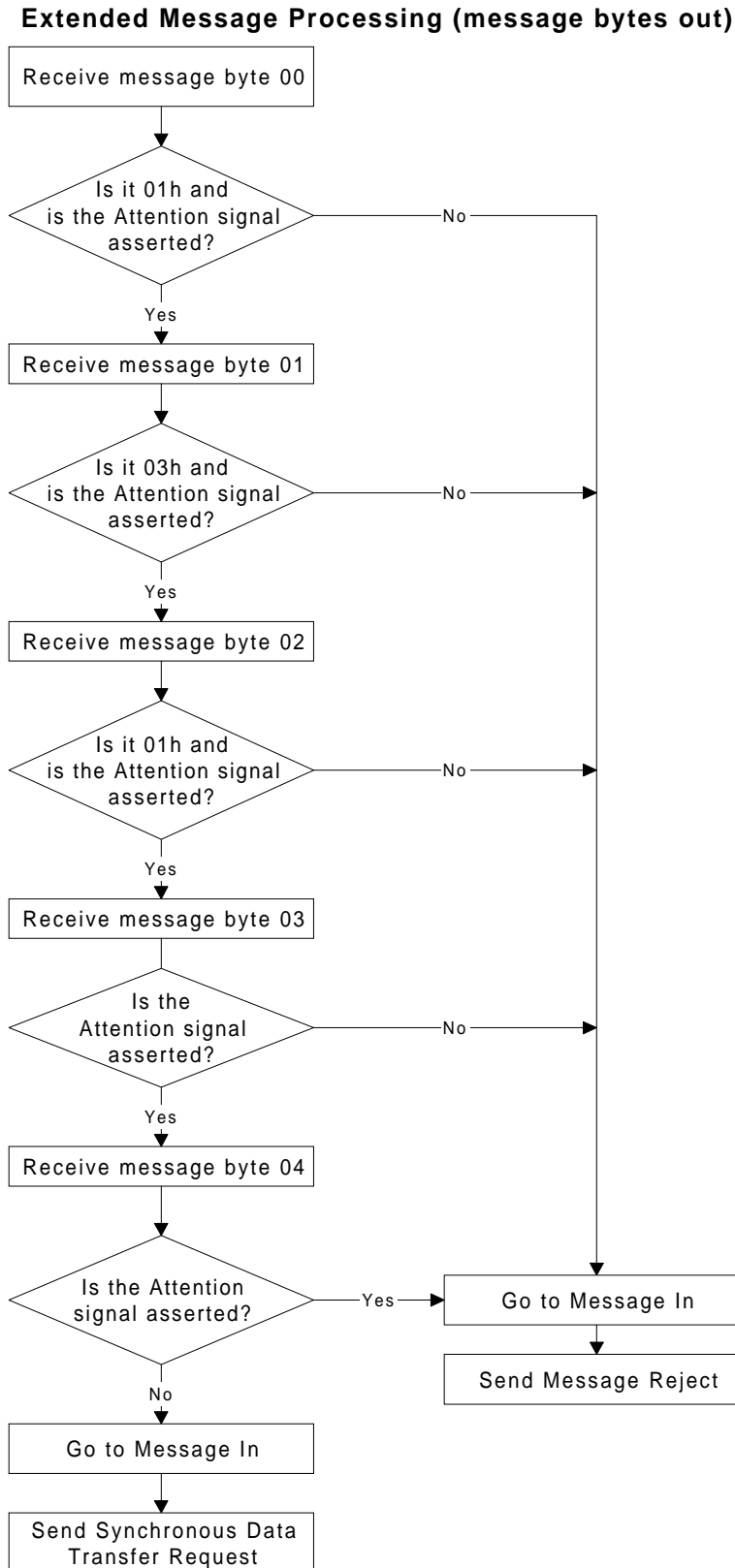
Figure A-6 Message processing of Extended Message Out bytes

Processing of Extended Message In

Figure A-7 shows how the Extended Message In messages are processed. The tape drive executes this message sequence in response to an initiator's Synchronous Data Transfer Request.

Parity Error in Extended Message In

If the initiator detects a parity error in the Synchronous Data Transfer Request byte being sent by the tape drive, it responds by sending a Message Parity Error message to the tape drive. The tape drive responds by re-sending the entire Synchronous Data Transfer Request. If the tape drive receives 16 consecutive Message Parity Error messages or one Message Reject message, it cancels the Synchronous Data Transfer Request and resumes asynchronous data transfer for that initiator.

Extended Message Processing (message bytes in)
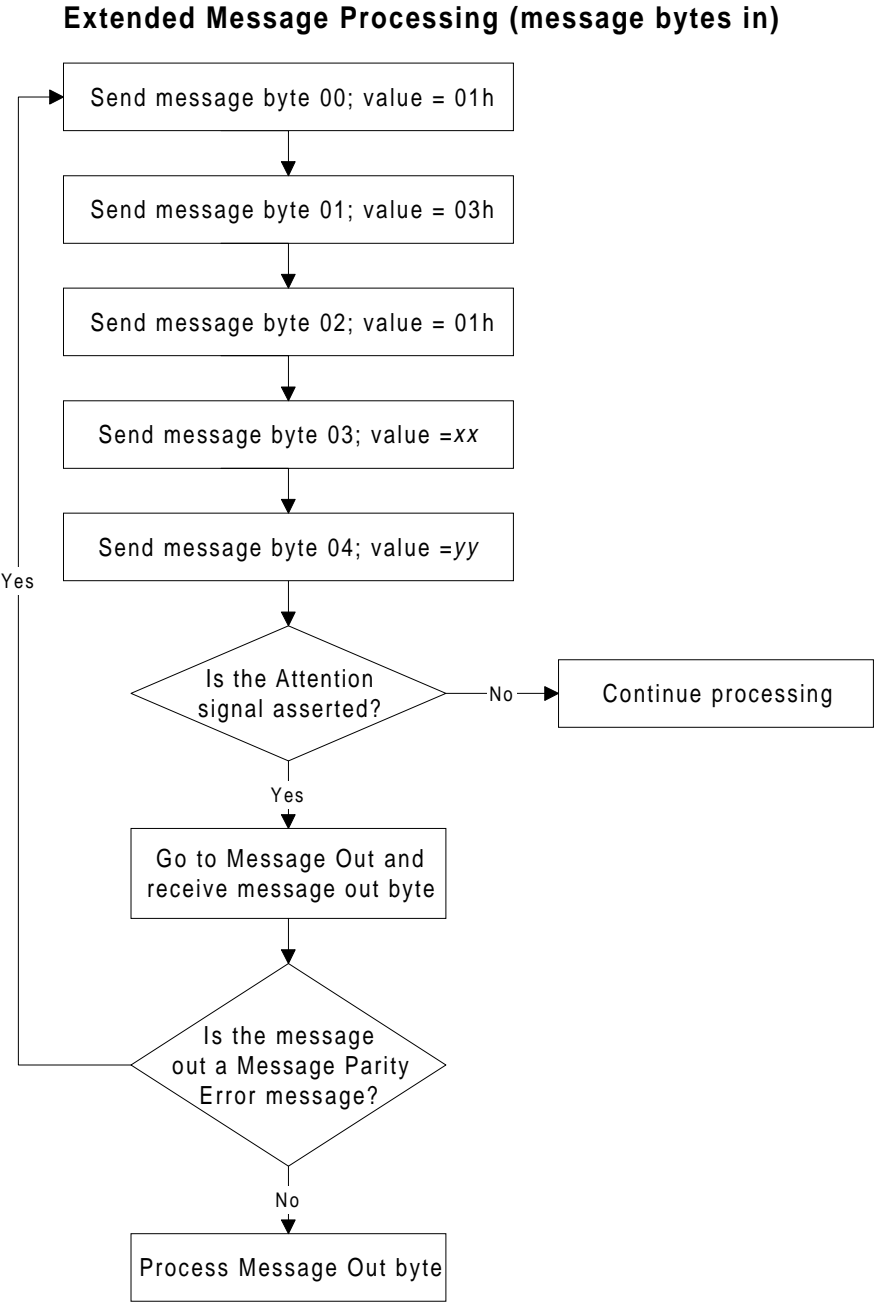
Figure A-7   Message processing for Synchronous Data Transfer Request message

Message Processing in Data Out Phase (WRITE Command)

Figure A-8 shows how each message is processed during the Data Out phase of a WRITE command.

Parity Error in User Data Associated with WRITE Command

When parity checking is enabled and the tape drive detects a parity error in the logical blocks of user data received from the initiator, the tape drive aborts the data transfer. The data block containing the parity error is not written to tape.

After aborting the data transfer, the tape drive sends Check Condition status to the initiator, followed by a Command Complete message. The sense key is set to Aborted Command (Bh) and the ASC and ASCQ bytes are set to 47h and 00h. The SCSI Bus Parity Error (BPE) bit is set to 1.

- **If you are attempting to write a variable-length block**, you may be able to recover by reissuing the WRITE command an unlimited number of times. Each time a failure is detected, the tape drive returns Check Condition status.

- **If you are attempting to write fixed-length blocks**, you may be able to recover by following these steps:

  1. Issue a REQUEST SENSE command.

  2. Look at the Information Bytes to determine how many fixed blocks need to be re-sent. These bytes indicate how many logical blocks were not transferred successfully (including the logical block with the parity error).

  3. Adjust the initiator's data pointer to reflect the number of blocks that were successfully transferred.

  4. Issue a WRITE command to re-send the blocks that were not successfully transferred.

Inital Phase: Data Out
Transition to: Message Out (write data to tape)
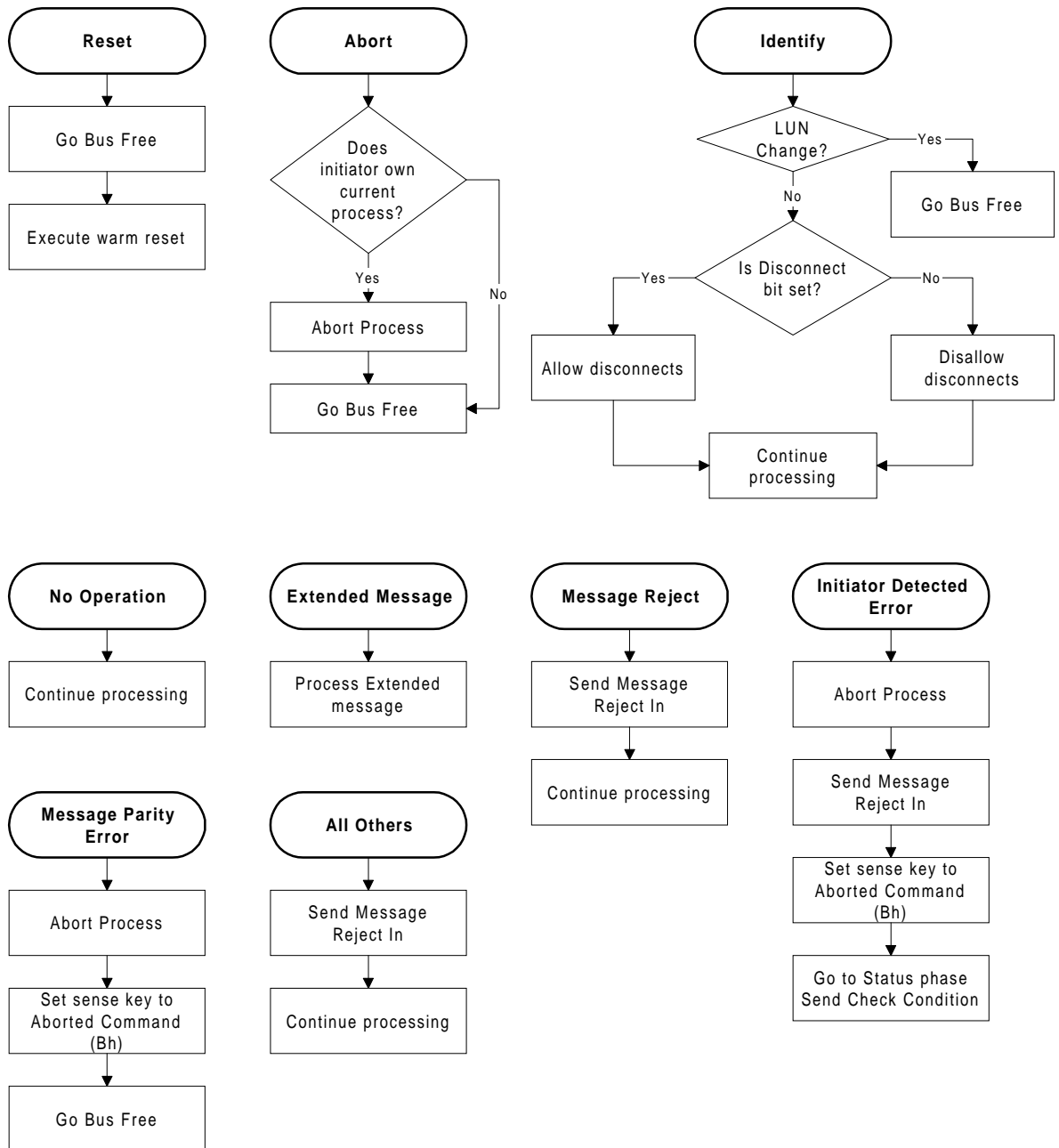
Figure A-8   Message processing during the Data Out phase of a WRITE command

Message Processing in Data Out Phase (Information Commands)

Figure A-9 shows how messages are processed during the Data Out phase for commands other than WRITE (for example, MODE SELECT).

Parity Error in Data Out Phase (Information Commands)

When parity checking is enabled and the tape drive detects a parity error in the data sent after the MODE SELECT or LOG SELECT CDB, it goes to the Message In phase and sends a Restore Pointers message. The initiator must restore the pointer to the start of the data. The tape drive then goes to the Data Out phase and requests the data again.

Figure A-10 shows how messages are processed after a Restore Data Pointers message is sent to the initiator while reattempting the Data Out phase for an information command.

The initiator should count the Restore Pointers messages received during the Data Out phase to qualify the communication. If the count exceeds some threshold, the initiator should clear the tape drive from the bus by doing one of the following:

- Sending the Abort message
- Performing a SCSI bus reset
- Sending the Bus Device Reset message
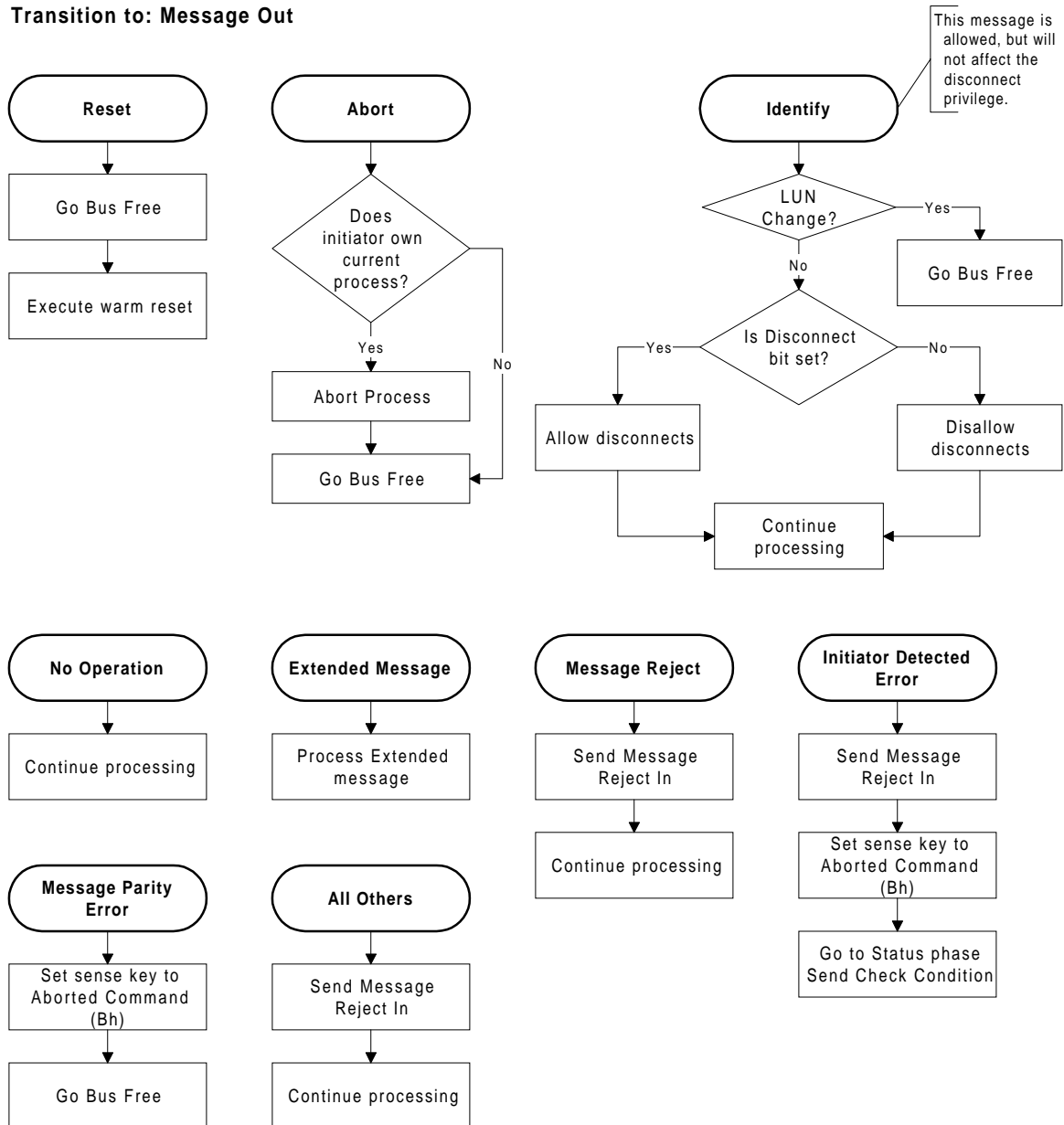
Inital Phase: Data Out (Information Command)
Transition to: Message Out (for example, MODE SELECT)
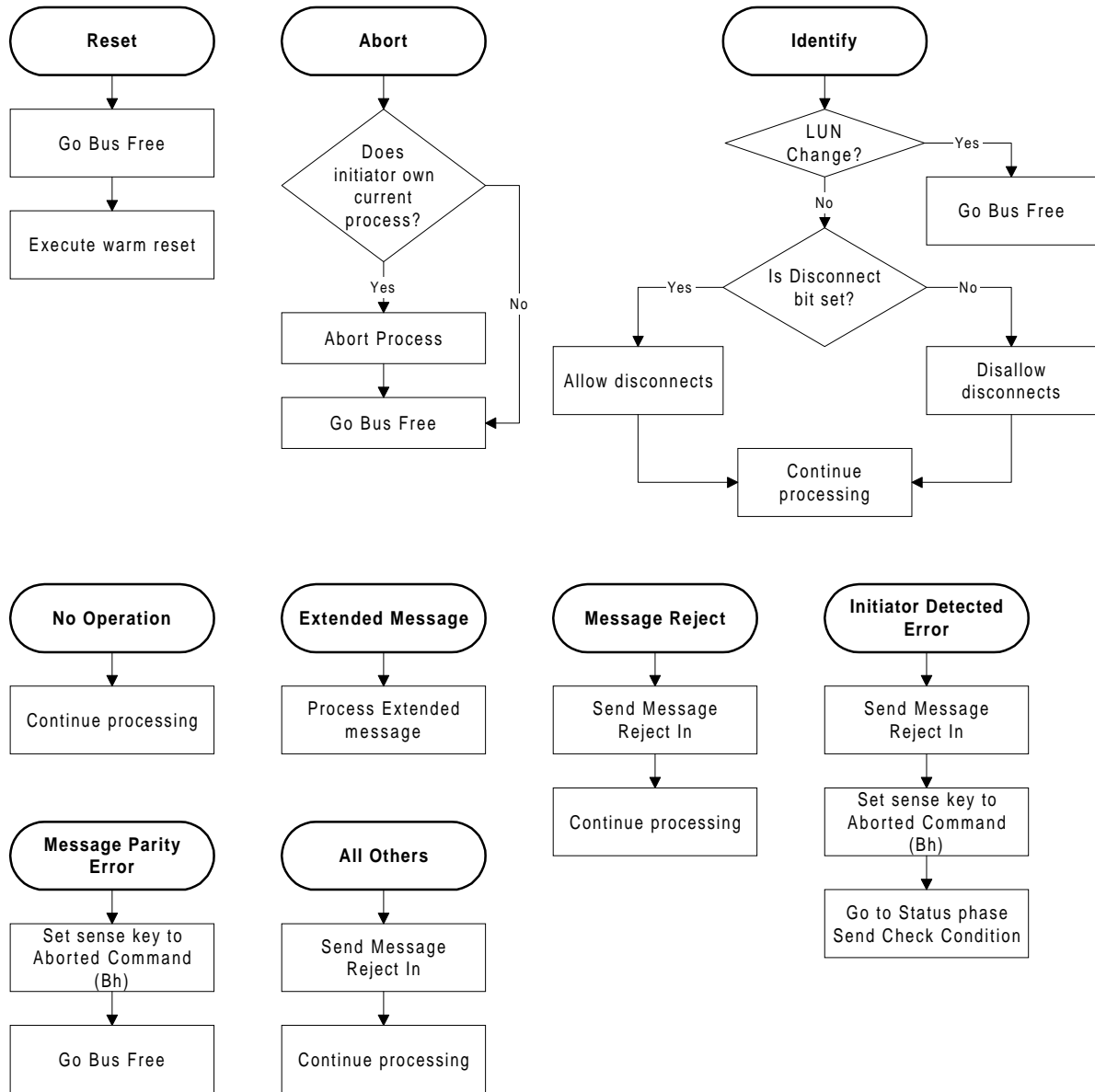
Figure A-9   Message processing during the Data Out phase for an information command

Inital Phase: Message In (Restore Data Pointers)
Transition to: Message Out (for example, MODE SELECT)

```
   ┌──────────┐              ┌──────────┐                              ┌──────────┐
   │  Reset   │              │  Abort   │                              │ Identify │
   └────┬─────┘              └────┬─────┘                              └────┬─────┘
        │                         │                                        │
   ┌────▼─────┐              ┌─────▼──────┐                          ┌──────▼──────┐  Yes
   │Go Bus Free│             │   Does     │──No──┐                   │    LUN      │──────┐
   └────┬─────┘              │ initiator  │      │                   │  Change?    │      │
        │                    │ own current│      │                   └──────┬──────┘      │
   ┌────▼──────┐             │  process?  │      │                          │ No    ┌─────▼─────┐
   │  Execute  │             └─────┬──────┘      │                   ┌───────▼──────┐│Go Bus Free│
   │ warm reset│                   │ Yes         │              Yes │Is Disconnect │└───────────┘
   └───────────┘             ┌─────▼──────┐      │            ┌─────│  bit set?    │── No ──┐
                             │Abort Process│      │           │     └──────────────┘       │
                             └─────┬──────┘      │      ┌─────▼──────┐            ┌──────────▼─┐
                             ┌─────▼──────┐◄─────┘      │   Allow    │            │  Disallow  │
                             │ Go Bus Free│             │ disconnects│            │disconnects │
                             └────────────┘             └─────┬──────┘            └─────┬──────┘
                                                              │    ┌──────────┐         │
                                                              └────►│ Continue │◄────────┘
                                                                    │processing│
                                                                    └──────────┘
```
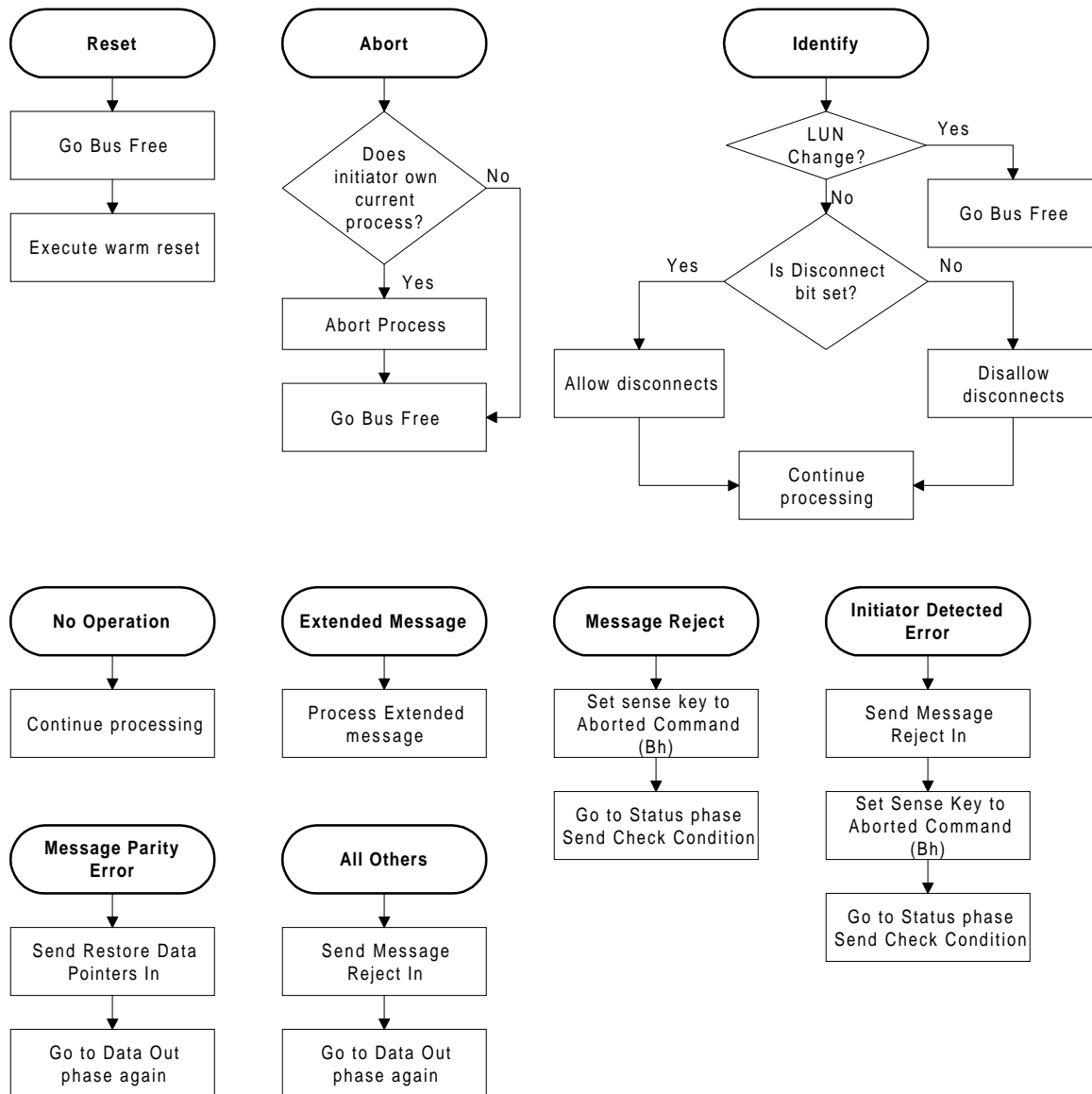

Figure A-10 Message processing after a Restore Data Pointers message when reattempting the Data Out phase for an information command

Message Processing in Data In Phase (READ Command)

Figure A-11 shows how messages are processed during the Data In phase of a READ command (that is, when the initiator asserts the Attention signal while it is receiving user data from the tape drive).

Parity Error in Data Associated with READ Command

If the initiator detects a parity error in data transferred from the tape drive during a READ command, it should assert the Attention signal. This causes the tape drive to stop the data transfer. The initiator should then send an Initiator Detected Error message to the tape drive.

When it receives the Initiator Detected Error, the tape drive assumes that a parity error has occurred and aborts the data transfer. The tape drive is positioned at the start of the next block.

After aborting the data transfer, the tape drive sends Check Condition status to the initiator followed by a Command Complete message. The sense key is set to Aborted Command (Bh), and the ASC and ASCQ are set to 47h and 00h. The SCSI Bus Parity Error bit is set to 1. In fixed-block mode, the Information bytes contain the number of blocks not sent to the initiator.

The initiator should backspace *n* blocks and attempt to reread the blocks by reissuing the READ command.

Inital Phase: Data In
Transition to: Message Out (read data from tape)

```
    Reset                    Abort                              Identify

  Go Bus Free              Does                                 LUN
                        initiator own                         Change?  ──Yes──
                           current
  Execute warm reset      process?                              No                Go Bus Free

                            Yes         No                   Is Disconnect
                                                    ──Yes──   bit set?   ──No──
                         Abort Process

                                                   Allow disconnects         Disallow
                          Go Bus Free                                        disconnects

                                                              Continue
                                                             processing
```

```
  No Operation          Extended Message        Message Reject        Initiator Detected
                                                                            Error

 Continue processing    Process Extended         Send Message
                            message               Reject In               Abort Process

                                                Continue processing     Set sense key to
                                                                        Aborted Command
                                                                              (Bh)

  Message Parity           All Others                                   Set Information bytes;
     Error                                                                 set Valid bit

   Abort Process         Send Message
                          Reject In                                     Go to Status phase
                                                                        Send Check Condition
 Set sense key to      Continue processing
 Aborted Command
      (Bh)

 Set Information bytes;
    set Valid bit

   Go Bus Free
```

Figure A-11 Message processing during the Data In phase of a READ command

Message Processing in Data In Phase (Information Commands)

Figure A-12 shows how messages are processed during the Data In phase for commands other than READ (for example, INQUIRY, REQUEST SENSE, and MODE SENSE).

Parity Error in Data In Phase (Information Commands)

If the initiator detects a parity error in data transferred from the tape drive during a REQUEST SENSE, MODE SENSE, LOG SENSE, READ POSITION, or INQUIRY command, it should assert the Attention signal. This causes the tape drive to stop the data transfer. The initiator should then send an Initiator Detected Error message to the tape drive.

When it receives the Initiator Detected Error, the tape drive issues a Restore Pointers message and re-sends the data.

Figure A-13 shows how messages are processed after a Restore Data Pointers message is sent to the initiator while reattempting the Data In phase for an information command.

Inital Phase: Data In (Information Command)
Transition to: Message Out (for example, INQUIRY, REQUEST SENSE)
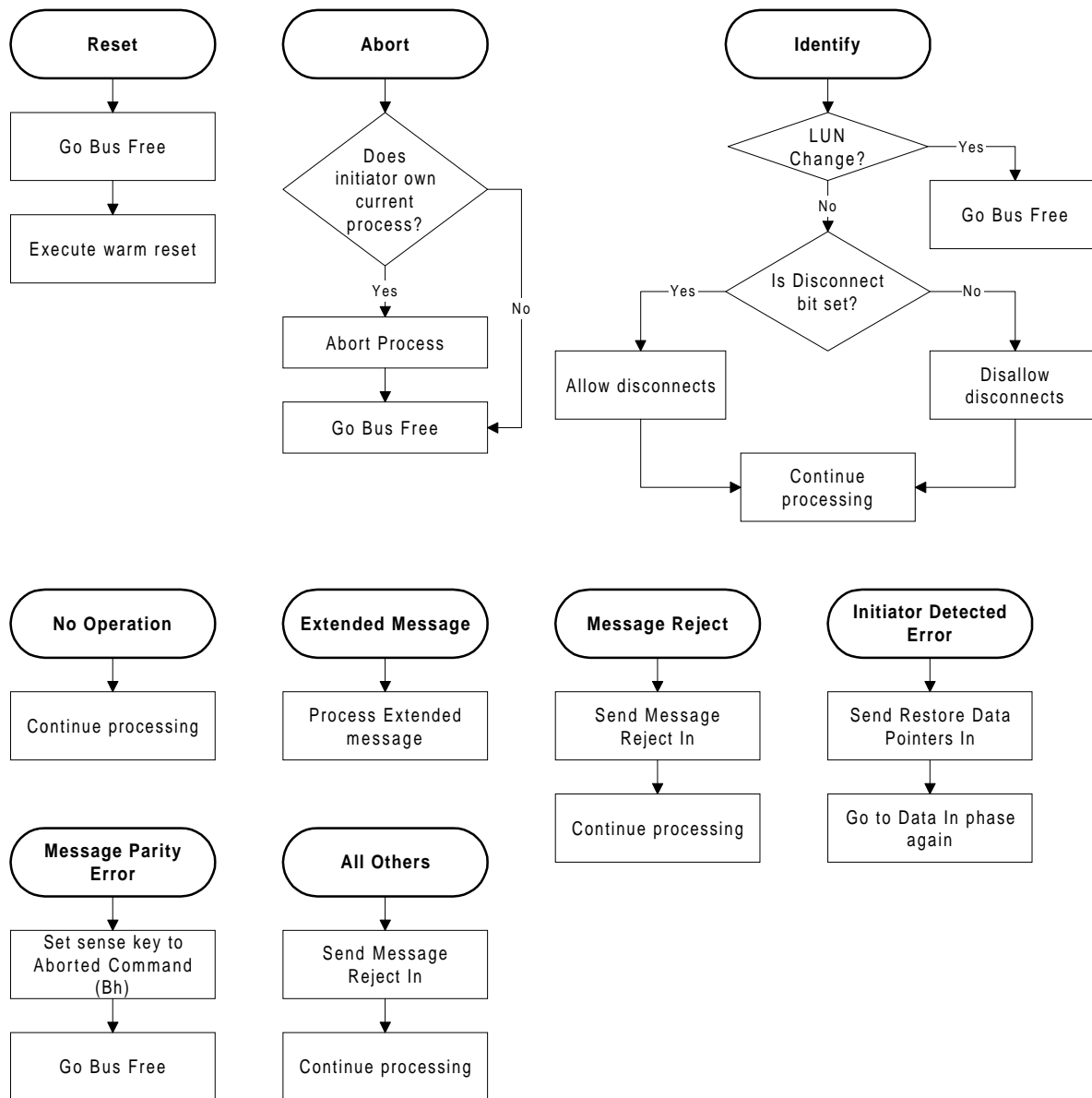
Figure A-12 Message processing during the Data In phase of an information command

Inital Phase: Message In (Restore Data Pointers)
Transition to: Message Out (for example, INQUIRY, REQUEST SENSE)
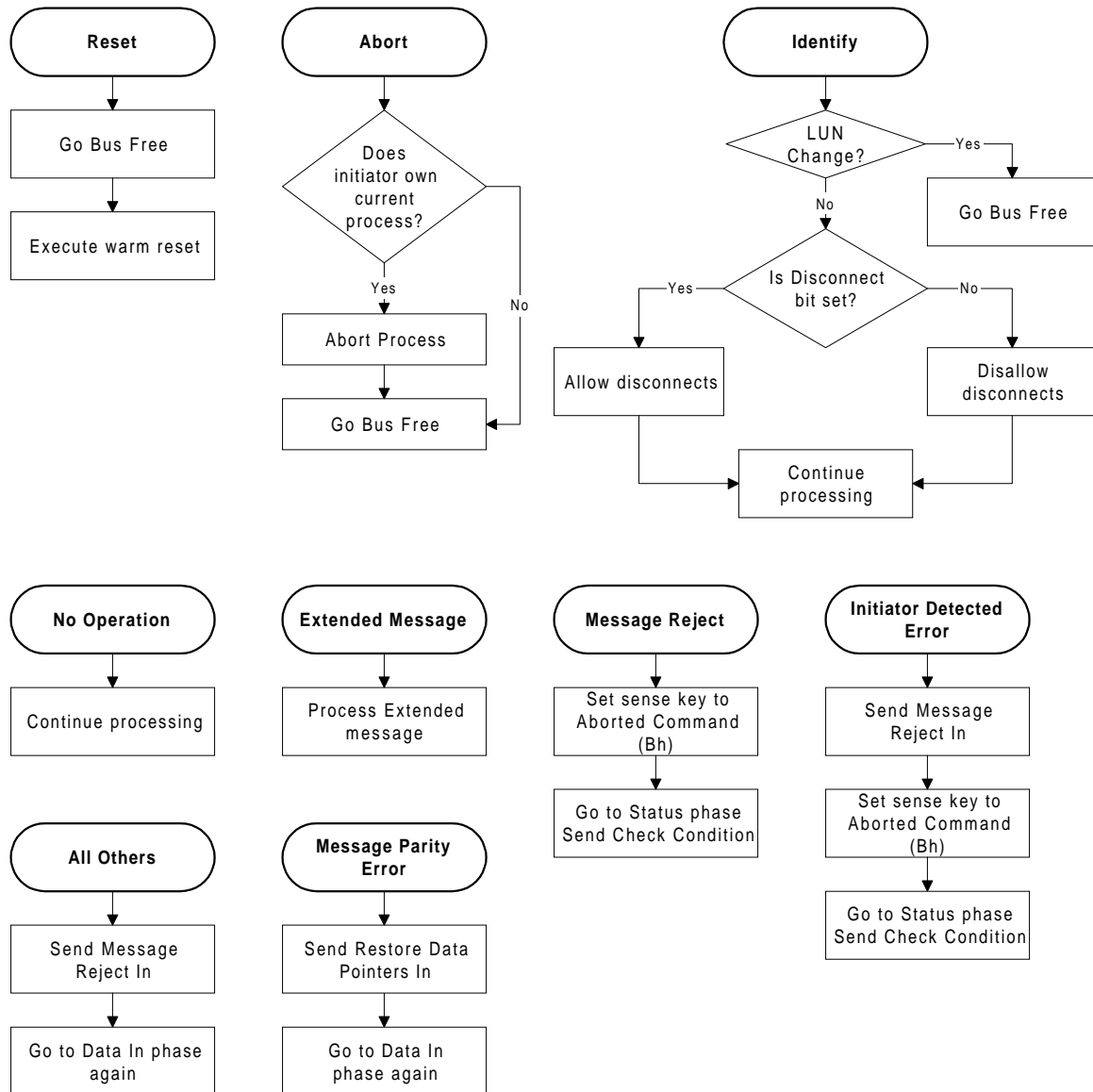
Figure A-13 Message processing after a Restore Data Pointers message when reattempting the Data In phase for an information command

Message Processing In Status In Phase

Figure A-14 shows how messages are processed during the Status In phase. Note that attempts to change the physical path characteristics are not processed.

Parity Error in Status In Phase

If the initiator detects a parity error on the status transferred from the tape drive, it should assert the Attention signal. This causes the tape drive to go to the Message Out phase. The initiator should then send an Initiator Detected Error message to the tape drive.

When the tape drive receives the Initiator Detected Error message, it issues a Restore Data Pointers message and resends the status. Figure A-15 shows how messages are processed after a Restore Data Pointers message is issued by the tape drive when reattempting the Status In phase.

The initiator should count the Restore Pointers messages received during the Data Out phase to qualify the communication. If the count exceeds some threshold, the initiator should clear the tape drive from the bus by doing one of the following:

- Sending the Abort message
- Performing a SCSI bus reset
- Sending the Bus Device Reset message

**Inital Phase: Status In
Transition to: Message Out**

This message is allowed, but will not affect the disconnect privilege.

```
Reset
  |
  v
Go Bus Free
  |
  v
Execute warm reset
```

```
Abort
  |
  v
Does initiator own current process?
  | Yes              No
  v                   |
Abort Process         |
  |                   |
  v                   v
Go Bus Free <---------
```

```
Identify
  |
  v
LUN Change? --Yes--> Go Bus Free
  | No
  v
Is Disconnect bit set?
  Yes                No
  |                   |
  v                   v
Allow disconnects   Disallow disconnects
  |                   |
  v                   v
  Continue processing
```

```
No Operation
  |
  v
Continue processing
```

```
Extended Message
  |
  v
Process Extended message
```

```
Message Reject
  |
  v
Send Message Reject In
  |
  v
Continue processing
```

```
Initiator Detected Error
  |
  v
Send Message Reject In
  |
  v
Set sense key to Aborted Command (Bh)
  |
  v
Go to Status phase Send Check Condition
```

```
Message Parity Error
  |
  v
Set sense key to Aborted Command (Bh)
  |
  v
Go Bus Free
```

```
All Others
  |
  v
Send Message Reject In
  |
  v
Continue processing
```

Figure A-14   Message processing during the Status In phase

Inital Phase: Message In (Restore Data Pointers)
Transition to: Message Out

This message is allowed, but will not affect the disconnect privilege.

Reset
↓
Go Bus Free
↓
Execute warm reset

Abort
↓
Does initiator own current process?
Yes ↓
Abort Process
↓
Go Bus Free
No →
(to Go Bus Free)

Identify
↓
LUN Change?
Yes → Go Bus Free
No ↓
Is Disconnect bit set?
Yes → Allow disconnects
No → Disallow disconnects
↓
Continue processing

No Operation
↓
Continue processing

Extended Message
↓
Process Extended message

Message Reject
↓
Send Message Reject In
↓
Send Command Complete

Initiator Detected Error
↓
Send Restore Data Pointers In
↓
Go to Status phase

Message Parity Error
↓
Send Message Reject In
↓
Go to Status phase again

All Others
↓
Send Message Reject In
↓
Go to Status phase again

Figure A-15   Message processing after a Restore Data Pointers message when reattempting the Status In phase

Message Processing in Message In Phase (Command Complete)

Figure A-16 shows how messages are processed while the tape drive is attempting to send the Command Complete message.

Parity Error Sending the Command Complete Message In

If the initiator detects a parity error during the Command Complete Message In phase, it sends a Message Parity Error message to the tape drive. The tape drive responds by re-sending the Command Complete message.

The initiator should count Message Parity Error messages to qualify the communication. If the count exceeds some threshold, the initiator should clear the tape drive from the bus by doing one of the following:

- Sending the Abort message
- Performing a SCSI bus reset
- Sending the Bus Device Reset message

Initial Phase: Message In (Command Complete)
Transition to: Message Out

```
┌──────────────────────┐        ┌──────────────────────┐
│ Message Parity Error │        │      All Others      │
└──────────────────────┘        └──────────────────────┘
            │                               │
            ▼                               ▼
┌──────────────────────┐        ┌──────────────────────┐
│    Send Command      │        │      Go Bus Free     │
│   Complete again     │        └──────────────────────┘
└──────────────────────┘
            │
            ▼
┌──────────────────────┐
│     Go Bus Free      │
└──────────────────────┘
```
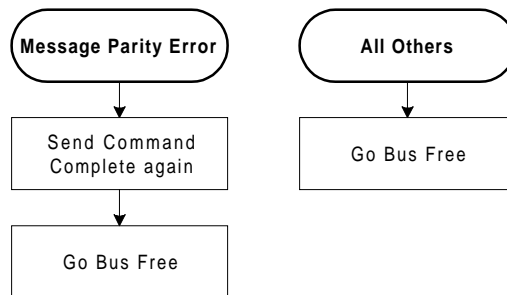
Figure A-16   Message processing during Command Complete Message In phase

Message Processing after Reselection

Figure A-17 shows how messages are processed after the tape drive has reselected the initiator and sent the Identify message in. Note that if the initiator sends the tape drive a Message Reject message, this will be treated as a catastrophic error committed by the initiator.

Parity Error Sending the Identify Message In

If the initiator detects a parity error when the tape drive sends the Identify message in, it responds by sending a Message Parity Error message to the tape drive. The tape drive responds by re-sending the Identify message.

The initiator should count Message Parity Error messages to qualify the communication. If the count exceeds some threshold, the initiator should clear the tape drive from the bus by doing one of the following:

- Sending the Abort message
- Performing a SCSI bus reset
- Sending the Bus Device Reset message

**Inital Phase: Reselection with Identify In
Transition to: Message Out**
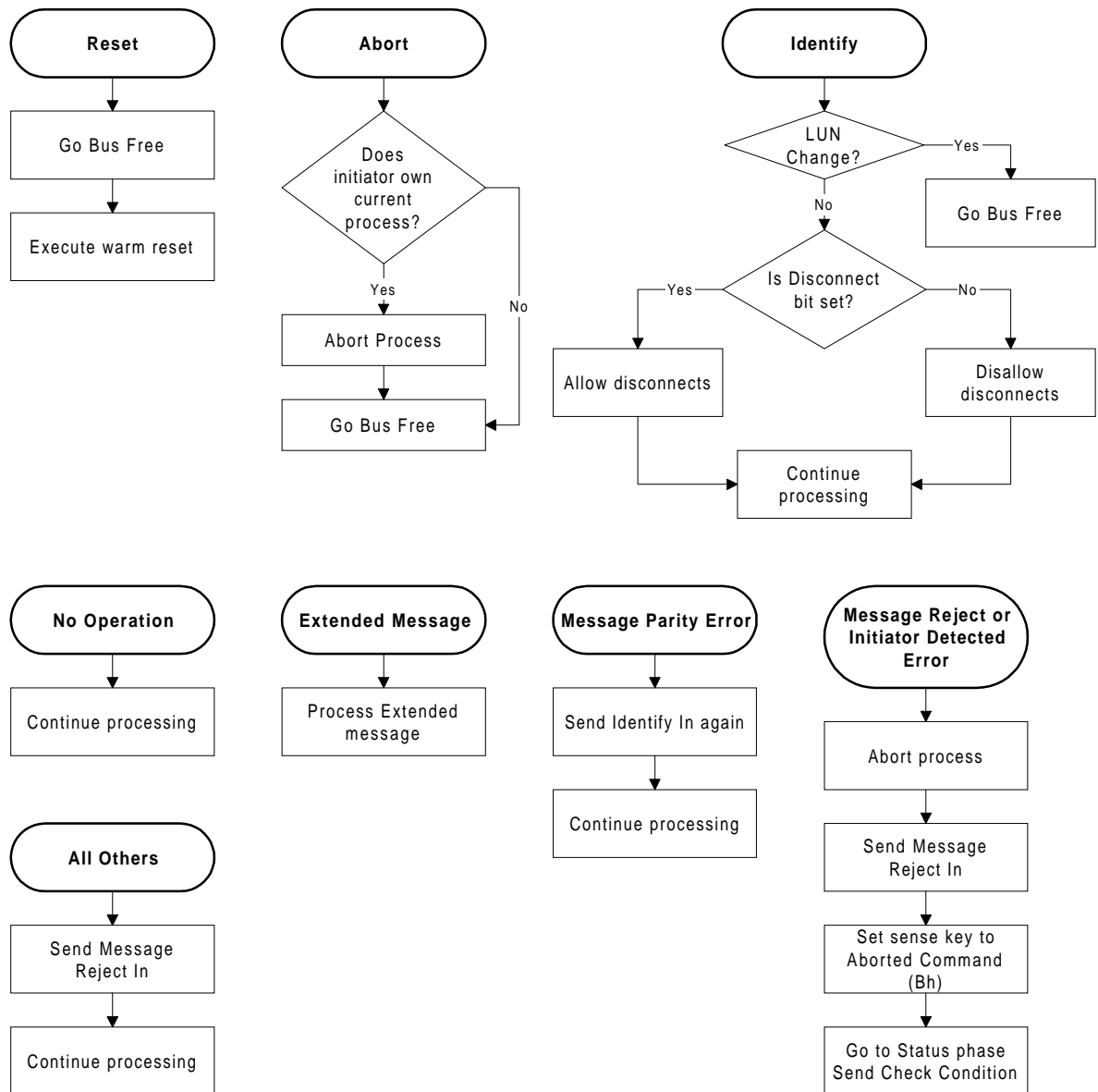
Figure A-17 Message processing after tape drive reselects initiator with Identify message

Message Processing during Disconnect Sequence

Figure A-18 shows how messages are processed while the tape drive is executing the "disconnect" sequence. Note that attempts to change the physical path characteristics are not allowed. Also, the disconnect sequence may be aborted if the initiator sends a Message Reject message.

Parity Error Sending Disconnect or Save Data Pointers Message In

If the initiator detects a parity error when the tape drive sends a Disconnect or Save Data Pointers message in, it responds by sending a Message Parity Error message to the tape drive. The tape drive responds by re-sending the Disconnect or Save Data Pointers message.

The initiator should count Message Parity Error messages to qualify the communication. If the count exceeds some threshold, the initiator should clear the tape drive from the bus by doing one of the following:

- Sending the Abort message
- Performing a SCSI bus reset
- Sending the Bus Device Reset message

**Inital Phase: Message In sending Save Data Pointers or Disconnect
Transition to: Message Out**
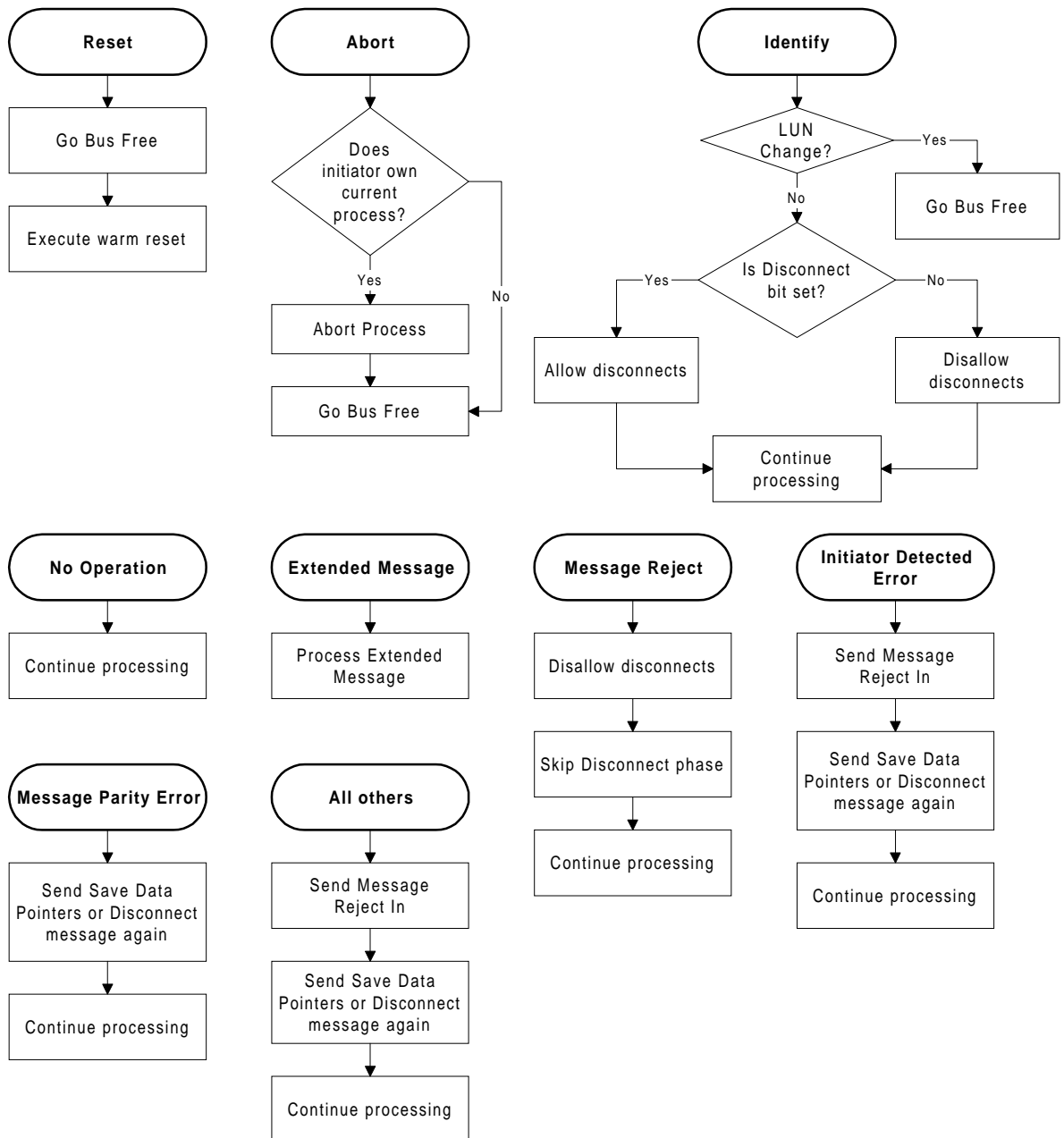
Figure A-18   Message processing while tape drive is executing the Disconnect sequence

Notes

B Error Information

This appendix is a reference for:

- The Additional Sense Codes (ASCs) and Additional Sense Code Qualifiers (ASCQs) returned by the REQUEST SENSE (03h) command. These codes provide additional information about each sense key.

- The Fault Symptom Codes (FSCs) returned by the REQUEST SENSE command. These Exabyte-unique codes can be used to determine the nature of hardware and software errors and other events. Recommended recovery procedures for each FSC are also provided.

B.1   REQUEST SENSE Information

This section lists the possible combinations of values for the Additional Sense Code (ASC) and the Additional Sense Code Qualifier (ASCQ) fields in the Extended Sense Bytes returned by the REQUEST SENSE (03h) command. Each ASC and ASCQ combination is correlated with one or more of the Exabyte-unique Fault Symptom Codes (FSC) that are returned as byte 28 in the Extended Sense Bytes.

For ease of reference, the information in this section is listed in numerical order for each sense key (byte 2, bits 3 through 0).

Sense Key = 0h (No Sense)

Table B-1 REQUEST SENSE information for Sense Key 0h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	00h	No additional sense information. Refer to the Fault Symptom code.	0Ah, E9h
00h	01h	A filemark was encountered during a read, space, or locate operation. The tape is positioned at the EOT-side of the filemark.	0Dh, 32h
00h	02h	LEOT or LEOP was encountered during a read, write, or write filemarks operation.	04h, 06h, 09h, 28h
00h	03h	A setmark was encountered during a read, space, or locate operation. The tape is positioned at the EOT-side of the setmark.	1Dh, 31h
00h	04h	PBOT or PBOP was encountered during a space or locate operation.	35h
0Ah	00h	The tape history log indicates a worn tape.	EDh
5Dh	00h	A tape drive component has exceeded its expected operational lifetime.	EEh

Sense Key = 1h (Recovered Error)

Table B-2 REQUEST SENSE information for Sense Key 1h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	17h	Cleaning requested by tape drive.	E8h
37h	00h	A parameter was out of range in the last LOG SELECT or MODE SELECT command. The parameter was rounded to a valid value and the operation was completed.	DCh
5Bh	02h	Log parameter overflow (a cumulative counter reached its maximum value of all FFs).	ECh
5Dh	00h	Tape Alert asynchronous notification.	F1h

Sense Key = 2h (Not Ready)

Table B-3   REQUEST SENSE information for Sense Key 2h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
04h	00h	Logical unit not ready. No additional sense information. Refer to the Fault Symptom Code.	C6h, C8h, DDh
04h	01h	Logical unit not ready, but is in process of becoming ready (rewinding or loading tape).	C7h
3Ah	00h	Logical unit not ready. Command requires a tape, and no tape is present.	C9h

Sense Key = 3h (Medium Error)

Table B-4   REQUEST SENSE information for Sense Key 3h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	02h	PEOT or PEOP was encountered during a space, locate, read, or verify operation.	14h, 34h
03h	02h	Excessive write errors.	94h, 96h, 97h, 9Bh, 9Dh-9Fh, B3h
09h	00h	Tracking error.	AEh, B0h
0Ch	00h	LBOT failure.	B4h
11h	00h	An uncorrectable block was encountered during a read, space, or locate operation.	37h, B5h
11h	01h	An uncorrectable block was encountered during a read operation.	0Bh
11h	03h	Too many permanent read errors—cannot sync.	11h
14h	00h	A Medium Error was detected during a read, space, or locate operation.	16h, 38h
15h	00h	There is no information at this position on tape. The tape drive cannot perform a space operation.	3Dh

Table B-4 REQUEST SENSE information for Sense Key 3h (*continued*)

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
26h	02h	A write buffer parameter value was invalid.	69h
30h	00h	Incompatible media was ejected after a LOAD command was issued.	47h
30h	01h	The tape format is incompatible with the tape drive.	1Ch
31h	00h	A tape format error was encountered during a space or locate operation, or a switch partition operation failed.	36h, 79h
31h	01h	The format partition operation failed.	74h
50h	01h	Write failure after retry limit (specified with MODE SELECT) exceeded.	95h

Sense Key = 4h (Hardware Error)

Table B-5 REQUEST SENSE information for Sense Key 4h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	00h	No additional sense information. Refer to the Fault Symptom code.	58h, 67h, 6Dh, FAh, FCh, FDh
08h	01h	Logical unit communication timeout.	9Ah, 9Ch
08h	02h	Logical unit communication parity error.	A4h, A5h, A7h, A8h
0Ch	00h	Hardware failure—Head sync error during write.	A1h
11h	00h	A hardware error was detected during a read operation.	17h, 18h
11h	02h	Read decompression CRC failed.	19h
15h	01h	Servo hardware failure.	ADh
40h	80h	Controller hardware failure.	8Dh
44h	00h	Firmware consistency failure.	8Ch, 98h, 99h, A2h, ACh

Sense Key = 5h (Illegal Request)

Table B-6 REQUEST SENSE information for Sense Key 5h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	05h	The tape drive was in write mode and a READ or VERIFY command was issued.	0Eh
1Ah	00h	Illegal transfer length in the CDB.	CCh, D4h
20h	00h	Illegal operation code.	CDh
24h	00h	Invalid field in the CDB.	CEh
25h	00h	Logical unit not supported.	CFh, D1h
26h	00h	Invalid field in parameter list.	D0h, EAh
26h	01h	The tape drive's boot PROM is not compatible with the new microcode being loaded.	66h
26h	02h	The code header, EEPROM image, or control load image was not valid when loading firmware.	61h, 63h, 65h
27h	00h	The data cartridge is write protected.	73h
30h	05h	Cannot write to tape—tape not AME or density not supported for write.	DBh, DEh
30h	02h	The tape format is incompatible with the command.	D7h
3Dh	00h	Illegal bit set in Identify message.	DAh
4Eh	00h	Overlapped commands attempted—Bad initiator-target-LUN (ITL) nexus.	D8h
50h	01h	Write append position error, or illegal position to format partitions or erase.	02h, 26h, 4Bh, 71h
53h	02h	Media removal prevented.	D2h
81h	00h	Mode mismatch. Fixed/variable.	D3h
84h	00h	Could not change the MODE SELECT parameters since the tape was not at LBOT (or LBOP).	D6h

Sense Key = 6h (Unit Attention)

Table B-7   REQUEST SENSE information for Sense Key 6h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
28h	00h	A new tape load has occurred, and the media may have been changed.	C1h
29h	00h	Power-on reset, SCSI bus reset, or device reset has occurred.	C0h
2Ah	01h	MODE SELECT parameters have been changed.	C2h
2Ah	02h	Log parameter changed.	CBh
30h	00h	Incompatible media was rejected after the cartridge was inserted.	C5h
3Fh	01h	New microcode (firmware) was loaded.	C3h
5Ah	01h	Operator requested media removal.	C4h
5Bh	01h	Log threshold met. (For additional information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)	CAh
5Dh	FFh	Tape Alert asynchronous notification test	F0h

Sense Key = 7h (Data Protect)

Table B-8   REQUEST SENSE information for Sense Key 7h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
27h	00h	The tape is write protected.	03h, 27h, 4Ch

Sense Key = 8h (Blank Check)

Table B-9   REQUEST SENSE information for Sense Key 8h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	00h	Host error in message system	DFh
00h	05h	End of data encountered.	0Ch, 0Fh, 33h

Sense Key = 9h (Exabyte)

Table B-10   REQUEST SENSE information for Sense Key 9h

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
15h	02h	Positioning error detected during a read, space, or locate operation.	15h, 3Ah

Sense Key = Bh (Aborted Command)

Table B-11   REQUEST SENSE information for Sense Key Bh

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	00h	No additional sense information. Refer to the Fault Symptom code.	05h, 10h, 3Bh, 4Eh, 75h, 7Ah, E7h, EBh
08h	02h	IPORT write or read parity error.	A3h, A6h
10h	00h	Compression Integrity Check failed.	08h
43h	00h	Message error.	E0h, E1h, E3h-E5h
47h	00h	The command was aborted because of a SCSI bus parity error.	E6h
48h	00h	Initiator detected error.	E2h

Sense Key = Dh (Volume Overflow)

Table B-12   REQUEST SENSE information for Sense Key Dh

ASC (Byte 12)	ASCQ (Byte 13)	Explanation	Related FSC
00h	02h	EOT or EOP encountered, or partition size too big for tape.	72h, 93h, AFh, B6h

B.2   Fault Symptom Codes

This section lists the Fault Symptom Codes that may be returned by the REQUEST SENSE (03h) command. The Fault Symptom Code is returned as byte 28 in the Extended Sense Bytes. It is an Exabyte-unique byte that specifies the reason for the most recent Check Condition status.

For ease of reference, the Fault Symptom Codes (FSC) are listed in hexadecimal order. The information provided for each code includes the sense key (SK) associated with the code, an error recovery procedure (ERP) code, and a brief description of the problem or event.

Note: For more information about the suggested actions for each ERP code, refer to "Error Recovery Procedures" on .

➤ **Important**   The Fault Symptom Codes may change as new revisions of the tape drive firmware become available. For this reason, be sure to check the documentation provided with new firmware releases for the most current list of codes.

Fault Symptom Code Descriptions

Table B-13 Fault Symptom Codes

FSC	SK	ERP	Description
02h	5h	11	A WRITE command was received when the tape was not at a legal position to write.
03h	7h	5	A WRITE command was received when the data cartridge was write protected.
04h	0h	11	LEOT or LEOP was encountered during the current write operation (the command may have terminated early).
05h	Bh	11	The write operation was aborted, as requested.
06h	0h	10	LEOT or LEOP was encountered during the last write operation (the command completed successfully).
08h	Bh	3	Compression Integrity Check failed.
09h	0h	11	LEOT or LEOP was encountered during a read operation.
0Ah	0h	11	The actual block size read did not match the requested block size during a read operation.
0Bh	3h	13, 9	An uncorrectable block was encountered during a read operation.
0Ch	8h	11	EOD was encountered during a read operation.
0Dh	0h	11	A filemark was encountered during a read or verify operation.
0Eh	5h	11	The tape drive was in write mode and a READ or VERIFY command was issued.
0Fh	8h	13	Already at blank tape, so it is an error to attempt a read operation.
10h	Bh	11	The read operation was aborted, as requested.
11h	3h	13	Too many permanent read errors—cannot sync.
14h	3h	11, 13	PEOT or PEOP was encountered during a read or verify operation.
15h	9h	13	An invalid file number was detected in a filemark during a read operation (8200 format tapes only).
16h	3h	13, 9	A Medium Error was detected during a read operation.
17h	4h	8, 3, 12	A Hardware Error was detected during a read operation.
18h	4h	8, 3, 12	Read decompression failed.
19h	Bh	8, 3, 12	Read decompression CRC failed.
1Ch	3h	14	The tape format is incompatible with the tape drive.
1Dh	0h	11	A setmark was encountered during a read or verify operation.
26h	5h	11	A WRITE FILEMARKS command was received when the tape was not at a legal position to write.

Table B-13 Fault Symptom Codes (*continued*)

FSC	SK	ERP	Description
27h	7h	5	A WRITE FILEMARKS command was received when the data cartridge was write protected.
28h	0h	11	LEOT or LEOP was encountered during or before the write filemarks operation—the filemark was written.
31h	0h	11	A setmark was encountered during a space operation.
32h	0h	11	A filemark was detected during a space operation.
33h	8h	11	EOD was encountered during a space or locate operation.
34h	3h	11	PEOT or PEOP was encountered during a space or locate operation.
35h	0h	1, 3	PBOT or PBOP was encountered during a space operation.
36h	3h	13	A tape format error was encountered during a space or locate operation.
37h	3h	13, 9	An uncorrectable block was encountered during a space or locate operation.
38h	3h	13, 9	A Medium Error was detected during a space or locate operation.
3Ah	9h	13	A wrong file number was encountered in a filemark during a space operation (8200 format tapes only).
3Bh	Bh	11	The SPACE or LOCATE command was aborted, as requested.
3Dh	3h	1, 9	There is no information at this position on tape. The tape drive cannot perform a space operation.
47h	3h	11	Incompatible media was ejected after a LOAD command was issued.
4Bh	5h	11	The tape is not at a legal place to erase.
4Ch	7h	5	The data cartridge is write protected and cannot be erased.
4Eh	Bh	11	The ERASE command was aborted, as requested.
58h	4h	11	An error occurred during the send diagnostics operation.
61h	5h	11	The code header was not valid when loading firmware.
63h	5h	11	The control load image was not valid when loading firmware.
65h	5h	11	The EEPROM load image was not valid when loading firmware.
66h	5h	11	The tape drive's boot PROM is not compatible with the new microcode being loaded.
67h	4h	12	One of the memories could not be programmed.
69h	3h	3	The CRC in the load image in the buffer was incorrect.
6Dh	4h	12	The READ BUFFER command failed.

Table B-13 Fault Symptom Codes (*continued*)

FSC	SK	ERP	Description
72h	Dh	11	The value you specified for the partition size was too big for the tape.
74h	3h	6	The format partition operation failed.
75h	Bh	11	The format partition operation was aborted.
79h	3h	3,11	The switch partitions operation failed.
7Ah	Bh	11	The switch partitions operation was aborted.
8Ch	4h	8	Controller firmware logic error.
8Dh	4h	8	Controller hardware failure.
93h	Dh	11	The physical end of partition (PEOP) was detected.
94h	3h	6	Write setmark failure after internal retry limit exceeded.[a]
95h	3h	6, 9	Write failure after retry limit (specified with MODE SELECT) exceeded.
96h	3h	6	Write filemark failure after internal retry limit exceeded.[a]
97h	3h	6	Write EOD failure after internal retry limit exceeded.[a]
98h	4h	8, 12	Invalid BRT.
99h	4h	8, 12	Buffer empty.
9Ah	4h	8, 12	Deformatter Intrp timeout on search.
9Bh	3h	6, 9	The read-back-check operation detected a different block type from what was written (old data is not being fully overwritten).
9Ch	4h	8, 12	Formatter Intrp timeout on write.
9Dh	3h	9, 6	Permanent write error—Write recovery failure.[b]
9Eh	3h	9, 6	Permanent write error—Rewrite threshold exceeded.[b]
9Fh	3h	9, 6	Servo zone read-back-check failure on a write.
A1h	4h	8, 12	Head sync error during write.
A2h	4h	8, 12	Underrun error during write.
A3h	Bh	13	IPORT write buffer parity error.
A4h	4h	8, 12	DPORT write buffer parity error.
A5h	4h	8	Buffer positioning lost during write abort process.
A6h	Bh	13	IPORT read buffer parity error.
A7h	4h	8, 12	DPORT read buffer parity error.
A8h	4h	8, 12	PPORT parity error.

Table B-13 Fault Symptom Codes (*continued*)

FSC	SK	ERP	Description
ACh	4h	9, 8, 3, 6	Servo software error.
ADh	4h	9, 8, 3, 6	Servo hardware failure.
AEh	3h	9, 8, 3, 6	Unable to achieve or maintain tracking.
AFh	Dh	11	PEOT or PEOP was encountered during a tape motion command.
B0h	3h	9, 8, 3, 6	Tape damaged—unable to achieve or maintain tracking.
B3h	3h	9, 8, 3, 6	LBOT or LBOP write failure—read-back-check criteria not met after retry limit exceeded.[a]
B4h	3h	9, 8, 3, 6	LBOT failure.
B5h	3h	9	Physical Read Manager could not read LBOT or LBOP.
B6h	Dh	11	EOT encountered during buffer flush.
C0h	6h	3	Power-on reset occurred.
C1h	6h	3	Data cartridge may have been changed.
C2h	6h	3	MODE SELECT parameters were changed.
C3h	6h	3	New microcode was loaded.
C4h	6h	3	Operator requested media removal.
C5h	6h	3	Incompatible media was rejected after the cartridge was inserted.
C6h	2h	7, 3	Cause not known, or cartridge may be inserted but tape not loaded in tape path.
C7h	2h	3	Not ready, but becoming ready.
C8h	2h	2, 3	A tape motion command is required to move the tape from its current location.
C9h	2h	7	The command requires a tape, but no tape is loaded.
CAh	6h	3	Log threshold met. (For more information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)
CBh	6h	3	Log parameter changed.
CCh	5h	4	Parameter List Length error in the MODE SELECT CDB.
CDh	5h	4	Illegal Op Code.
CEh	5h	4	Invalid field or reserved bits set in the CDB.
CFh	5h	4	The LUN is not supported.
D0h	5h	4	Invalid field in Parameter List (MODE SELECT).
D1h	5h	4	The LUN in the Identify message is illegal (not zero).

Table B-13 Fault Symptom Codes (*continued*)

FSC	SK	ERP	Description
D2h	5h	11	Media removal is prevented.
D3h	5h	4	A variable/fixed mismatch occurred between the CDB and the MODE SELECT parameters.
D4h	5h	4	Illegal transfer length in CDB.
D6h	5h	11	Could not change the MODE SELECT parameters since the tape was not at LBOT (or LBOP).
D7h	5h	11	The tape format is incompatible with the command.
D8h	5h	3	Overlapped commands attempted—Bad initiator-target-LUN (ITL) nexus.
DAh	5h	4	Illegal bit set in Identify message.
DBh	5h	6	Cannot write to tape; tape not AME.
DCh	1h	10	A parameter was out of range in the last LOG SELECT or MODE SELECT command. The parameter was rounded to a valid value and the operation was completed.
DDh	2h	6	Head sync tape in tape drive.
DEh	5h	6	Cannot write to tape—density not supported for write.
DFh	8h	11	Host error in message system.
E0h	Bh	3	The command was aborted in the CDB phase (parity or other error), or a reconnect attempt failed after the allowed number of retries.
E1h	Bh	3	The command was aborted before the Data phase—Received bad message. Bad Identify message.
E2h	Bh	11	The command was aborted in the Data phase—Initiator Detected Error message.
E3h	Bh	3	The command was aborted in the Data phase—Received bad message out.
E4h	Bh	3	The command was aborted after the Data phase—Received bad message out.
E5h	Bh	3	The command was aborted after the Data phase—Other error.
E6h	Bh	3	The WRITE command was aborted because of a SCSI bus parity error.
E7h	Bh	11	The initiator sent an Abort or Initiator Detected Error message during a read operation and the command was aborted.
E8h	1h	12	Cleaning requested by tape drive.
E9h	0h	10	Cleaning occurred.

Table B-13 Fault Symptom Codes (*continued*)

FSC	SK	ERP	Description
EAh	5h	4	Conflict between Density Code and Data Compression Page in MODE SELECT.
EBh	Bh	11	Operation illegal during a WRITE BUFFER command sequence. WRITE BUFFER sequence aborted.
ECh	1h	10, 11	Log parameter overflow (a cumulative counter reached its maximum value of all FFs).
EDh	0h	6, 11	The tape history log indicates a worn tape.
EEh	0h	12	A tape drive component has exceeded its expected operational lifetime.
F0h	6h	10	Tape Alert asynchronous notification test.
F1h	1h	11	Tape Alert asynchronous notification.
FAh	4h	15	The tape drive's serial number is invalid or blank.
FCh	4h	15	Head sync value in EEPROM is out of range.
FDh	4h	15	The EEPROM contains meaningless information.

[a] If the read-back-check criteria are not met for an LBOT or LBOP, filemark, setmark, or EOD block written to tape, the tape drive moves the tape backward and retries the operation the number of times specified by the Write Retry Count (byte 08 of the MODE SENSE data). If the read-back-check criteria are still not met, the tape drive returns Check Condition status and these FSCs apply.

[b] If the read-back-check criteria are not met for a data or short filemark block (that is, if the block is not perfect), the block is rewritten. If rewrite activity is excessive, the tape drive moves the tape backward, reads the tape to verify that blocks are written, and then moves the tape backward again. It then performs a write splice operation and rewrites the blocks. If the rewrite threshold is exceeded for any block, the tape drive returns Check Condition status with the sense key set to Medium Error (3h) and the FSC set to 9Eh. If the recovery splice operation cannot be completed, the FSC is 9Dh.

Error Recovery Procedures

The following table describes the error recovery procedures (ERPs) recommended for each Fault Symptom Code listed in the previous section.

Note: If two or more ERP codes are listed for the Fault Symptom Code, perform the action for the first code, then perform the action for the second code, and so on.

Table B-14 Recommended error recovery procedures

ERP	Recommended Error Recovery Procedure
1	Issue a REWIND command and retry the operation.
2	Issue a SPACE command to space backward over a block or a filemark.
3	Reissue the failed command or command sequence.
4	Correct the errors in the CDB bytes or parameter data.
5	Move the write protect switch on the data cartridge to write enable the tape.
6	Repeat the operation with a new data cartridge.
7	Insert a data cartridge into the tape drive.
8	Perform one of the following actions: ▪ Power the tape drive off and back on again. ▪ Send a SCSI bus reset ("hard" reset). ▪ Reset the tape drive by holding down the eject button for > 10 seconds, and then releasing it.
9	Clean the tape drive and repeat the operation.
10	No action is necessary.
11	User should determine what recovery procedure to follow.
12	The tape drive requires maintenance.
13	1. Perform one of the following actions: • Issue a REWIND, SPACE, LOAD/UNLOAD, or LOCATE command • Press the unload button • Power the tape drive off and back on again • Send a SCSI bus reset ("hard" reset) 2. Reissue the failed command or command sequence.
14	Repeat the operation with a different data cartridge; the tape drive cannot read the tape.
15	Reprogram the EEPROM.

Notes

C Using a Microcode Update Tape

Exabyte may periodically release new levels of microcode for the tape drive. When new releases are available, you can obtain microcode update files on 8mm tape from Exabyte Technical Support. You can also download microcode files from the Exabyte Technical Support bulletin board or the Exabyte World Wide Web site (http://www.exabyte.com).

The following instructions explain how to use the microcode update tape. You can also use the WRITE BUFFER command to copy microcode from a microcode file to your tape drive across the SCSI bus. (See Chapter 25 for instructions.)

C.1 Procedure for Updating Microcode

1. Make sure that a SCSI bus reset cannot occur during the microcode update process. To do this, make sure that there is no activity on the SCSI bus involving the host computer and any other devices on the bus.

   If you have a single-ended tape drive, you can disconnect it from the SCSI bus to ensure that a reset cannot occur. If you disconnect the tape drive and it has an external terminator, remove the terminator also. (Some tabletop tape drive enclosures and tape libraries use external terminators.)

If you have a differential tape drive, do not disconnect it from the SCSI bus and do not remove the terminator.

CAUTION

If a SCSI bus reset occurs during the microcode update process, the tape drive may not be operable. If this happens, use the Mammoth Monitor program to reload the microcode from the * .i file.

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2. Apply power to the tape drive.

3. After the tape drive's power-on self-test completes (all three LEDs off), insert the microcode update tape. The tape drive automatically detects the presence of the update tape and upgrades the microcode. No operator intervention is needed. The update process takes two to three minutes. When the process is complete, the tape drive ejects the tape.

   Note: If possible, write the new microcode level on the tape drive's label.

4. Replace the tape drive's terminator if you removed it, and reconnect the tape drive to the SCSI bus if you disconnected it.

If the Microcode Update Fails

If the tape drive has not ejected the tape after several minutes, the microcode update has failed. Push the unload button to eject the tape and restore normal tape drive operation. Then, repeat the code update process. If it fails again, you can use Mammoth Monitor to load the code from diskettes over the tape drive's diagnostic port.

C.2   Obtaining a Microcode Update Tape

To obtain a microcode update tape, contact Exabyte Technical Support at 1-800-445-7736 or 303-417-7792. You can also contact Exabyte Technical Support by email: support@ exabtyte.com. Technical Support will help you determine the specific code you need and provide you with instructions for obtaining the tape.

If you need to make copies or backups of existing FECODE or MODE SELECT options, you can create your own microcode update tapes using the Mammoth Monitor program. Mammoth Monitor is a PC-based tool that is available from Exabyte.

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